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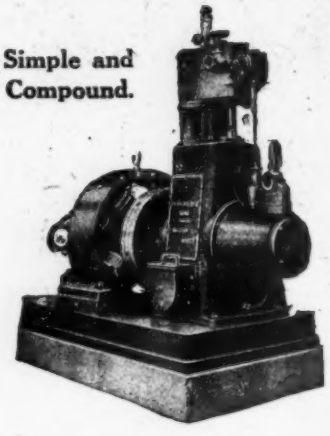

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ELECTRICAL REVIEW.

Vol. LXXXVII. DECEMBER 24, 1920. No. 2,248.

ELECTRICAL REVIEW.

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THE HEATING OF BURIED CABLES.

WE desire to take the earliest opportunity of offering our congratulations to the British Electrical and Allied Industries Research Association on the promptitude with which it has issued a Preliminary Report on this subject, and to the Institution of Electrical Engineers for the facilities which it has afforded for the circulation and discussion of it. While the Report only purports to be of a preliminary nature, it contains much matter of value both to the manufacturers and to the users of power cables. The inclusion of this Report in the *Journal* of the I.E.E. will do much to remove the reproach that the *Journal* contains only a very small number of contributions dealing with cables, while the quality of the Report and the programme of outstanding work permit us to draw the conclusion that the final Report will be of an epoch-making character.

The present publication will do much to let the world know that British engineers are not lagging behind their confrères in America and elsewhere in their determination to increase the sum of knowledge regarding power cables. Already, for any given set of conditions of intended working, it is possible to indicate closely the performance which may be expected from any cable or group of cables, and it seems probable that during the next two or three years all the factors will be known which will enable engineers to take account of all the chief variables.

These variable conditions in connection with cable work tend to make the designing and installation of a cable network and transmission system an occupation for an expert. It is being realised that the old rule-of-thumb methods must go. The sums to be invested in cables during the next 10 years are so large that it is imperative, in the best interests of the electricity supply industry, that the closest consideration of the expert should be given to all new cable lay-outs, and, fortunately, these experts exist and are quite well known. We were much impressed with a remark in the discussion to the effect that the progress of the research had been delayed through lack of funds, among a variety of reasons. We venture to express the hope that the interest of cable users and of the Electricity Commissioners will be so much stimulated by the Report and by the need for pressing on with the remaining investigations that funds in abundance will be forthcoming. Is it too much to hope that the Councils of the I.M.E.A. and of the I.A.E.P.C. will spontaneously suggest to their constituents the advisability of offering effective help to the B.E.A.I.R.A. for this investigation?

The attendance at the London meeting was so sparse that we can only assume that cable users are satisfied with the products of the British cable makers, and with the composition of the strong and representative Committee which has this investigation in hand. This view is supported by the absence of any serious criticisms—other than constructive ones. In our view, therefore, the Committee may feel assured that it carries the confidence of the whole industry in the difficult and valuable work which it has undertaken and which must take a few years still to complete. Having regard to the immense sums to be laid out in cables in every country, we would strongly urge the Committee and the Association to press

forward the remainder of the work with all possible speed, and to issue, as early as possible, a further interim Report dealing with the important subject of the dielectric losses in modern 3-core cables for 20,000 and 30,000 volts. Allied to this is the problem of the use of single-core cables for extra-high-pressure A.C. work, and we trust that the terms of reference to the Committee may be extended to cover an investigation of this matter.

Relief from Onerous Contract.

The case of the North Metropolitan Electric Power Supply Company *v.* Mayor of Stoke Newington, which is reported elsewhere in this issue, involved a point of great importance to supply companies which have found it difficult to perform contracts entered into before the war. In the year 1917 an Act was passed by which in the case of a contract entered into before January 1st, 1917, if the Court is satisfied that owing to the alteration of trade conditions occasioned by the war the contract cannot be enforced according to its terms without serious hardship, the Court may, after considering all the circumstances of the case and the position of all parties to the contract and any offer which may have been made by any party for a variation of the contract, suspend or annul, or, with the consent of the parties, amend the contract on such terms as the Court may think fit.

The facts of the case were very simple. Under contracts made in 1904, 1906, and 1911 the plaintiff company were bound to supply electricity in bulk to the Borough of Stoke Newington. They sought relief on the ground that owing to the war they could not supply on the agreed terms except at a heavy loss. It was shown that coal had risen from 17s. 6d. a ton in 1914 to 58s. 10½d. a ton at the present time, and that the wages of engine drivers had risen from 7½d. an hour in 1914 to over 2s. an hour. Mr. Justice Lawrence pointed out that the plaintiffs had to satisfy him that there had been an alteration in trade conditions affecting the supply of electrical energy; that such alteration was caused by the war, and that by reason of such alteration the enforcement of the agreement or agreements sought to have annulled would cause serious hardship. He found all three points in favour of the plaintiff company, and it is interesting to notice that the fact that the alteration of trade conditions was caused by the war was proved to his satisfaction, not by the plaintiffs, but by an affidavit filed on behalf of the defendants! On the question of serious hardship he accepted figures put forward by the company which showed an annual loss of £2,622 at the present time. Having regard to the figures given for 1914, the company were entitled to expect to be making a profit instead of a loss in 1920, and they were making a loss, although the demand in 1919 was nearly double what it was in 1914. In these circumstances he felt justified in exercising the power conferred upon him by the legislature and directed that the contracts should be annulled.

"I believe," he said, "that this is the first occasion on which the legislature has conferred such an arbitrary power upon the Court. It must, however, be remembered that this power is an emergency power conferred only because of the great dislocation of almost all commercial transactions caused by the greatest war in which England has ever been engaged." It appears from the report of his Lordship's judgment that certain offers had been made by the defendants, but it is apparent that they were not, in his opinion, such as the plaintiffs were bound to accept. While Mr. Justice Lawrence was certainly correct in saying that this was the first case of its kind, it should be remembered that for a long time County Court judges have been exercising an arbitrary jurisdiction in setting aside contracts between landlord and tenant.

The case under review will serve as a useful reminder of the fact that electrical energy is a commodity which is costly to produce; that production has been rendered more expensive by rises in the price of coal and large increases in wages, and that electric supply companies are not philanthropic institutions. While it is probable that this case will lead to applications of a similar nature, Mr. Justice Lawrence was careful to point out that each case must be decided on its own facts. At the same time, those who hold any supply company bound by a contract entered into before the year 1917 should give the most careful consideration to any suggestion which may be made by the company to relieve them of some of the burden. As regards the relations between companies and individual consumers, it is probable that the principles underlying this judgment can have no application, because the vast majority of such contracts are of comparatively short duration, and there are few now current which were entered into prior to January, 1917.

The New Electricity Supply Bill.

We congratulate the Ministry of Transport, or the Electricity Commissioners, or whoever was responsible for the reception of the Press on Tuesday last week, when the Parliamentary Secretary of the Ministry of Transport explained the situation as regards the old and new Electricity Bills. It was an excellent idea, and calculated to be of great help all round, especially to the lay Press. It is no easy matter to get the purport and incidence of a Bill from a hasty reading, and to fit it into proper relationship with existing legislation. Technical Bills especially may easily give rise to misconception. But no one could listen to Mr. Neal's ten minutes' explanation of the new Bill without having a perfectly clear idea of the whole affair; and when, in addition, full opportunity was given for questions to be asked, the situation was surely an ideal one for the journalist. On that occasion indeed, there was almost a pontifical impressiveness in the array of ministerial Olympians genially condescending to the interrogations of the humble pressman. The quintessence of electrotechnical wisdom was "on tap." So, if the purport of the new Bill was not reflected accurately in the Press, it was not the fault of the Ministry or the Electricity Commissioners.

The present Bill, which had been on the Order Paper all this year, has been withdrawn, and its place is taken by a new Bill, of which the chief object is to confer upon the Joint Electricity Authorities the necessary powers to enable them to raise the capital they require. Until such financial clauses are made law, the Electricity Commissioners cannot make the orders establishing the Authorities. The Electricity Commissioners have now done everything possible to assist in the formation of such authorities, so it is up to the undertakers in the various areas to take full advantage of these legislative powers. As we have previously remarked, the heterogeneous composition of such Authorities does not favour their speedy establishment. Whether wiser counsels will now prevail, and the old rivalries and insensate jealousies between the various local authorities and others be abandoned in the common interest, remains to be seen. If the Commissioners do succeed in welding together these hitherto intractable elements in the various districts delimited, the feat will certainly reflect the greatest credit on their administration and powers of conciliation.

So much for the main feature of the Bill. To existing undertakings individually there is granted a very welcome concession with regard to the intervals at which they may apply for a revision of their maximum charges. At present this is every five years; the new Bill reduces this period to three years. Further, companies which have not hitherto come under the clause governing such powers of revision will now be brought in, and local authorities will also rank *pari passu* with the companies with regard to all such privileges (which is not the case under the present electric lighting law).

These provisions, together with others calculated to facilitate the relief and reconstruction of the electricity supply industry, are wholly desirable, and we trust that the Bill will be carried through at the earliest possible opportunity.

THE INSHES HYDRO-ELECTRIC INSTALLATION.

An Interesting 50-kw. Water-Power Scheme.

The possibilities of harnessing the water-power of small streams in Scotland were exemplified at a pleasant ceremony on October 2nd last, when the hydro-electric plant described below was successfully inaugurated. Incidentally, the scheme shows what can be done in this direction at a moderate cost, and it may be pointed out that it is unique inasmuch as there is no other similar plant in this country which feeds surplus energy into a town's public supply network. Small as the supply from this source is, it has proved, as explained below, of considerable value to the burgh electricity supply undertaking, and has been the means of effecting considerable economies in the working of the undertaking; this feature of the scheme is of considerable significance.

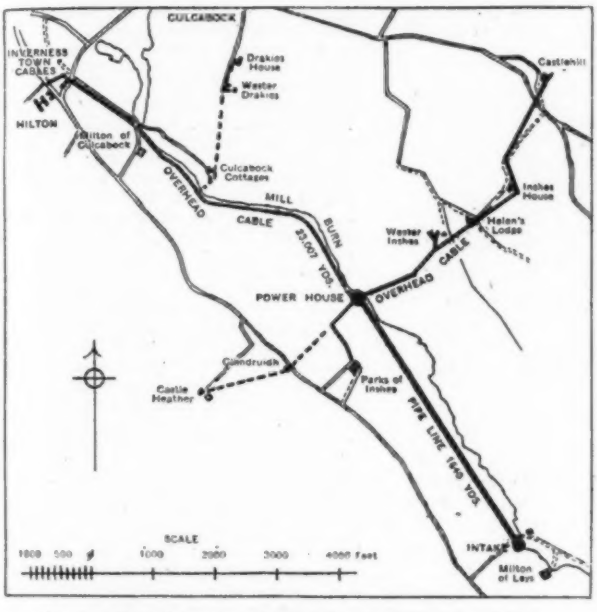


Fig. 1.—Pipe Line and Overhead Transmission Lines, Inshes Hydro-electric Scheme.

Early last year the estate of Inshes, which lies about 2½ miles to the south-west of Inverness, Scotland, was purchased by a well-known Highlander, Mr. R. L. MacKintosh, who ordered extensive additions to the Mansion House of Inshes, and wished to introduce electric lighting and power. Mr. MacKintosh proposed, if possible, to install an electrical plant which would be useful to his neighbours as well as to himself, and investigations were accordingly made into the possibilities of utilising water power on the estate.

Rising in the moorland above the 600-ft. contour line on the south of the estate is the small Millburn, which from its source to its out-fall into the sea is only about 2½ miles in length, but many years ago it had no fewer than six mills on its banks. The mills were all operated by water wheels, four of them of the overshot type, giving a combined total output of about 40 h.p. At the present day only one of the wheels remains in use, but near the mouth of the burn is a small turbine of about 8 h.p. at the Millburn Distillery. The burn is fed from springs, and the flow is very regular, readings taken over six months of last year giving an average of 120 cb. ft. per minute, the minimum being 90 cb. ft.

It was decided to utilise the burn to its fullest possible extent and to feed the surplus energy, after the requirements of Inshes House and the other houses on the hillside had been met, into the local town underground cable network, 1¼ miles distant (as shown in fig. 1). It was estimated that surplus energy up to a maximum of 20 kw. could be absorbed in this network, and the plant installed was, therefore, of such a capacity as to utilise the maximum flow of the burn.

The scheme comprises a pipe-line, a view of which, looking towards the power house, is shown in fig. 3, of 12-in. cast-iron pipes, 1,640 yards in length (which was constructed during the winter season so as not to interfere with agricultural work), a gross head of 320 ft. being obtained at the power house, where is installed a "Turgo" impulse turbine by Messrs. Gilkes & Co., of Kendal. This machine, fig. 2, on a net head of 310 ft. and taking 96 cb. ft. of water per minute, gives 34 b.h.p., the loss due to friction head being then only 9·7 ft.; taking 224 cb. ft. per minute, it will give 88·3 h.p., the loss due to friction head then being 53 ft. The turbine is fitted with a sensitive shaft governor, a slipper deflector, and a spear regulating nozzle; the regulating nozzle is adjusted by hand so as to utilise all the water available in the burn, there being no storage. The pipe-line intake is shown in fig. 4.

Coupled to either side of the turbine is a compound-wound protected type generator, each being of 22-kw. capacity at 250 volts, and to the shafts of these machines are attached two line boosters capable of dealing with the whole output of the generators. The boosters are shunt-wound and hand-regulated, the speed of the set being 950 r.p.m. The generators and boosters were made by Messrs. Electromotors, Ltd.

On the switchboard, by Messrs. Whipp & Bourne, is mounted only the minimum number of instruments, and very simple switchgear. It is fitted with a change-over switch, so that if the turbine is stopped for cleaning, the local circuits can be fed from the town network. The whole of the plant is housed in a neat power house of brick with a pavilion roof of slate, the internal dimensions being only 24 ft. × 12 ft. (fig. 5).

Between the power house and the town network is a pole line, the terminal poles of which are illustrated in figs. 5 and 6, 1¼ miles in length, carrying two 0·1 sq. in. outer conductors, with two No. 6 neutral wires. The current on this line can be given a boost of 90 volts, if necessary. Running alongside of the hill in a westerly direction is another pole line conveying the supply to Inshes House,

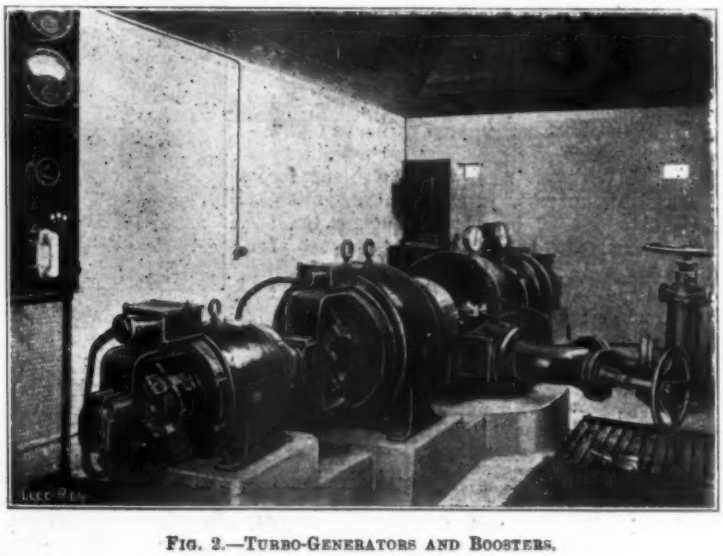


Fig. 2.—Turbo-Generators and Boosters.

1,000 yards distant, with an extension of 200 yards of underground cable across the park, and a further 400 yards of pole line to Castle Hill House.

At Inshes House the lighting installation consists of about 150 30-watt lamps, and there are connections for a number of heating points for intermittent use (the house being kept warm with a central heating system), a cooker in the kitchen, a hot plate in the dining-room, and a washing machine and irons in the laundry.

At Castle Hill the lighting installation consists of about 70 30-watt lamps, and there are connections for a few heating points, a washing machine, and irons. At this house there is also an 8-H.P. motor to drive the farm machinery.

Eastwards from the power house there is a pole line 600 yards in length to the Parks of Inshes farmhouse and

FIG. 3.—PIPE-LINE.

FIG. 4.—PIPE-LINE INTAKE.

the farm buildings. Here the lighting of the house and farm buildings consists of about 10 0 30-watt lamps. There are also connections for a numberrof heating points in the house, and the farm machinery is d iven by a 10-H.P. motor. This line is being extended to supply another private house and farmhouse and farm buildings, about half a mile distant.

The plant has now been in operation for two months, and has in every way fulfilled expectations. The machinery runs constantly night and day, and is visited once daily by an attendant from the local electricity works. It has been stopped for a few minutes once a week, so that the governor can be lubricated. The supply from the scheme has enabled the local electricity works to dispense with a Sunday morning shift of two men, and it has also reduced the running hours of the steam plant by at least one hour per day, it being possible to start up half-an-hour later in the morning, and shut down at least half-an-hour earlier at night.

The scheme was prepared and carried out by Mr. E. J. Williams, manager for Scotland for Messrs. Edmundson's Electricity Corporation, Ltd., who have 37 branches throughout Great Britain, and who have in hand a number of other hydro-electric installations in the north of Scotland—evidence that the high cost of coal and oil is at last directing attention to the value of water-power in Britain. The North of Scotland Electric Light and Power Co., Ltd., of which Mr. Williams is also manager, is the company which purchases the surplus energy from the Inshes scheme.

Electric Heating and Cooking in France.—French manufacturers of electric heating and cooking apparatus have formed themselves into a syndicate, with a board of management and Paris offices, their object being not only the defence of their professional interests, but the development, by common action, of the use of electricity for heating and cooking, for which a wide field is foreseen with the growing multiplication of hydro-electric central stations throughout France. Experience obtained abroad, they aver, shows that these appliances and processes are now absolutely dependable.

A SYMPOSIUM ON ELECTROPLATING.

DISCUSSION AT SHEFFIELD BEFORE THE FARADAY SOCIETY AND THE INSTITUTE OF METALS.

ON March 19th the Faraday Society and the Sheffield section of the Institute of Metals met jointly in the Mappin Hall of the University to receive and discuss a series of papers dealing with some of the problems that confront or interest the electroplater. Conferences of this kind have frequently been held in America, but this is probably the first meeting of its kind in this country, where it must be confessed electroplating is often carried out by men who have no scientific understanding of their art, and by methods frequently so inefficient that they would have been discarded a generation ago in many another branch of electrotechnics. Apart, therefore, from the direct value of the papers and discussions, and these were by no means inconsiderable, the meeting should be productive of even more indirect benefit by the stimulus it has undoubtedly given to a deeper regard for the scientific aspects of an industry so little addicted to open debate, and in which so much useless and indeed mischievous secrecy and reticence still reside—always a symptom, be it noted, not of knowledge, but of ignorance.

In the afternoon session papers dealing with electroplating generally were brought forward. Prof. C. H. DESCH presided over this session. In the evening, when Mr. E. A. SMITH was in the chair, discussion was entirely devoted to silver plating, an industry which is largely centred in the city of Sheffield.

ELECTROPLATING.

Dr. LESLIE AITCHISON opened the proceedings of Part I with a general paper discussing how electroplating is and can be applied for the prevention of corrosion. The protection of iron and steel against rust was the matter chiefly dealt with, and it was shown that the protective coating must not only itself be able to resist attack by oxygen and moisture, weak acids, and electrolytes, but must be mechanically impervious to the passage of these agents. Leaving aside paints and varnishes, by far the most important metallic protective coatings are tin and zinc applied hot, in tinplate and galvanised iron. Nevertheless, electroplating has manifold advantages in special cases, particularly where application must be made in the cold so as not to injure the base article, and we find, therefore, that where a regulated weight of deposit is needed, or a superior appearance desired, electro-depositing

FIG. 5.—POWER HOUSE AND TERMINAL POLE.

FIG. 6.—TERMINAL POLE WITH METER BOX AT TOWN NETWORK.

is the most satisfactory method of procedure. Zinc plating is now largely employed to protect aircraft parts, and a coating less than a thousandth of an inch in thickness can be applied so uniformly that it affords adequate resistance to corrosion under aircraft conditions. In such cases, apart from the possibility of depositing so thin a coating, only a cold process could be employed, for hot tinning or galvanising would destroy entirely the heat treatment condition of these special steel aircraft parts. Other protective metals in common use for iron and steel are nickel, tin, and copper. Theoretically zinc, which is electro positive to iron, should protect it completely, while copper, which is electro negative to it, should accelerate corrosion of the base, for in the case of an iron-zinc couple the zinc will dissolve, while with an iron-copper couple the iron will be attacked. In practice, however, when the protective coating is pierced the iron corrodes whether the covering be of zinc or copper, although it corrodes

much less in the former case. This curious fact is probably due to want of homogeneity in the iron itself, and the consequent formation of minute local couples, the action of which is, however, retarded by the proximity of the more electro-positive zinc, but accelerated by the proximity of copper.

Closely allied to the subject of this paper was that by Mr. S. Field, A.R.C.S., on "The Commercial Electrolysis of Zinc Sulphate Solutions." Practically all cold galvanising is effected with these solutions, hence the practical importance of the subject. But a still more important use of zinc sulphate solutions is in the recovery by the wet method of zinc from zinc ores, a method that has recently been developed to a great extent in America and Tasmania, and which bids fair in the end to supersede the scientifically-barbarous distillation method. In the wet method the leaching of the ore gives rise to zinc sulphate in solution, and after purification of the solution, the zinc is recovered by electrolysis, using a lead anode and an aluminium cathode. The solution may contain to begin with some 8 per cent. of zinc and 3 per cent. free sulphuric acid; as electrolysis proceeds the percentage of acid of course rises. Mr. Field in his paper discussed the question of the maximum current density it is possible to employ so that the efficiency shall not fall below such a point that an increased expenditure of energy is no longer economical. He also considered other factors that affect the current efficiency, such as the amount of zinc in solution, temperature, and impurities. The latter point was particularly emphasised, and it was stated that the effects of the presence in solution of a few parts in a million of nickel and cobalt affect disastrously the mechanical properties and even the physical continuity of the zinc deposits. The nickel and cobalt remain in solution, and must be got rid of before electrolysis. The addition of certain colloids improves the deposit, but only temporarily. Traces of nickel and cobalt may increase the power consumption from some 3,000 kilowatt-hours per ton of zinc to over 4,000.

In electro galvanising the effect of using impure anodes is similarly harmful. In most cases the mechanical properties of the deposit must be of high quality; it never must flake, frequently it must be possible to bend the galvanised article without cracking or removing the deposit. In such cases the presence of impurities in the zinc is fatal, for such deposits are invariably brittle.

Another commentary on the opening paper was that by Capt. W. A. Thain, A.M.I.C.E., dealing with "Applications of Electro Depositing in Aeronautical Engineering." The paper dealt with the use of copper only, and discussed—

(1) The use of copper depositing as a protection against carburisation in case-hardening;

(2) Copper depositing on aero-engine cylinder surfaces to increase the thermal conductivity;

(3) The building up of definite constructive units by copper deposition—for example, the copper water-jacket of the Beardmore aero-engine cylinder.

A considerable amount of useful information relating to the preparation of iron and steel articles for the plating bath and the best conditions for getting good deposits will be found in the paper when it is published. Unfortunately it was not possible to have it in type at the meeting.

Mr. Byron Carr described his researches on "Cobalt Plating," and set forth the conditions he had found best for securing good and reliable deposits. Cobalt plating as a substitute for nickel plating, or perhaps even steel facing, is likely to have a future. Some years ago some Canadian investigators drew attention to the extraordinarily high current densities that can be used in cobalt plating, thus enabling a sound facing deposit to be thrown down in a very few minutes. Later researches have confirmed this striking fact, but they have also made it clear that it is only under very limited conditions that the deposits are regular, sound and bright. Using a bath containing 4¼ lb. of cobalt sulphate, 5 oz. of boric acid, and 2½ oz. of sodium chloride per gallon and working at 34° C., current densities of 150 amps. per sq. ft. can be employed. Mr. Carr's work is a valuable contribution to our knowledge of these conditions, and is the first study of cobalt plating that has appeared in this country.

A communication by Mr. W. R. Hughes on "The Use of Colloids in the Electro-deposition of Metals" drew attention to a fascinating section of electroplating that is hardly understood at all, in which such knowledge as we have is purely empirical, and where systematic research is urgently called for. It is well known that some metals, such as lead, cannot be deposited at all in a coherent form unless a colloid be in the solution. In other cases, such as zinc or copper deposition, the quality of the metal may be greatly improved. In some cases, such as silver, a bright instead of a dull deposit may be precipitated. Many addition-salts can be made to act in the same way as colloids. The phenomenon bristles with obscurities. In Mr. Hughes's opinion the effect of the colloid is to diminish the size of the crystal grain in the deposited metal. It is a pity that this matter was not discussed—perhaps it is rather a matter for the 'pure' electrochemists—but anyhow it is of value to have drawn more attention to a matter of which the elucidation is so desirable.

Electro Silver Plating.

Discussion in this section was opened by Mr. W. R. Barclay, and it centred largely round the quality of bath that yields the best deposits, and the important question of current density. Mr. Barclay recommended a bath containing 5½ oz. double cyanide of silver and potassium per gallon and 3½ oz. free cyanide, worked at 17 to 23° C., with a current density of about 3 amps. per sq. ft. The discussion emphasised the necessity for further experimental study as to the precise reason for the beneficial effects—or the reverse—of such addition agents to the ordinary double cyanide bath of salts such as potassium chloride, sulphate, cyanate and formate, most of which are found in commercial baths. A considerable amount of empirical and trade knowledge exists on these matters, but at present its scientific bearing is hardly understood.

Much such information has been collected and tabulated in a valuable paper presented by Mr. G. B. Brook and Mr. L. W. Holmes, entitled "The Chemical Composition of Old Silver-plating Solutions with Observations on their Working Properties." It is difficult to summarise this paper because its chief value lies in its tabular analyses of some 60 solutions collected from various works in Sheffield and elsewhere, some of which have been in use for nearly 50 years. Side by side with the analyses are given the conductivities and the working properties of these solutions. Only a practical electrochemist or a skilled plater can appraise this mass of co-ordinated material at its true value and appreciate its usefulness. At present, however, the work is incomplete, for while determinations have been made of the amount of silver, double cyanide, free cyanide, and potassium carbonate in solution, the authors have not yet found time to determine the rarer impurities, such as cyanates and thiocyanates.

For the present the general conclusion reached was that the best solutions—as well as the most economical from the current consumption standpoint—were those of highest conductivity, and that conductivity was largely a function of potassium carbonate content. Now this impurity is the very one chiefly found in the old solutions, resulting both from the impure cyanide used a generation ago and from the long-continued absorption of carbonic acid gas from the air. It is therefore the presence of carbonate that gives superiority to the old solutions, a result which was confirmed in Mr. Barclay's paper and by the independent and perhaps prior evidence of Brunner and his own experiments.

The value of potassium carbonate in a silver bath in a direction other than improving the quality of the deposit was brought out in Mr. Frank Mason's paper, "A New Maximum Current Density in Commercial Silver Plating." In the solution normally used for plating, if a high current-density—say, exceeding 3 or 4 amperes per sq. ft.—be used the deposit is of a large crystalline grain, so much so that a high finish cannot be obtained, on account of its hardness, anyhow without undue expenditure of labour. If the current density greatly exceeds the above figures, the deposit is liable to be "burnt" and be entirely useless. Mr. Mason has discovered—or let us say re-discovered, so as to meet criticism on the score of priority—that from a solution containing more free cyanide than is the usual practice, and also potassium carbonate in quantities far larger than those accidentally present in many commercial solutions, silver can be deposited at a current density at least double the present rates, and that even so the deposit is of an exceptionally fine texture and takes a brilliant finish. A commercial bath containing—

Silver	... ...	26.14 grammes per litre
Free cyanide	...	47.25 grammes per litre
Potassium carbonate		165.00 grammes per litre

was worked under ordinary conditions, but with a current density of 8 amps. per sq. ft., and after depositing 8,000 ozs. of silver the crystalline structure of the deposit and its finish after burnishing was found to be indistinguishable from a first-rate deposit made from an ordinary commercial bath. If substantiated by experience, and in spite of some timorous adverse criticism it would appear that Mr. Mason's claim is a valid one, the result should be of considerable importance to the electroplating industry, for it will be possible to double the capacity of existing plating baths and thus almost halve the overhead charges on electroplating.

Mr. G. B. Brook read a second paper, in which he set out to explain a trouble common in the electroplating trade, namely, the occasional appearance of a peculiar cloudy effect upon burnished silver which is intensified by rough polishing, and which in that case takes the form of red patches. Mr. Brook ascribes this to the result of using too high a current density. He showed that in these circumstances individual silver crystals of an acicular or needle form tend to be deposited. The burnishing process lays down these crystals, but in the interstices so left the polishing material lodges, and hence the reddish patches referred to. Other speakers disagreed with Mr. Brook's explanation, but their criticism did not seem conclusive to us, and it is of course possible that causes other than this may lead to the effect described.

The last paper on the programme was by Mr. S. Field, and it described an experimental study of the deposition of gold-silver alloys, a subject, strange to say, which has scarcely been investigated previously by the electrochemist. Apart from its intrinsic interest, the deposition of gold-silver alloys has some industrial bearing, for the well-known "green gold" deposit consists of one of these alloys. Mr. Field, who is a past-master on the subject of depositing alloys, has studied the influence of varying conditions on the composition of the deposit, which in the absence of hydrogen deposition can be calculated from the ratio of its total mass to that of the

copper deposited in a coulomb meter in the circuit. In a cyanide solution, which naturally was used, gold is more positive than silver. It was found that the higher the current density and the more dilute the solution, the greater was the percentage of gold deposited. In the somewhat dilute solution ordinarily used for depositing "green" gold, the proportion of gold thrown down is almost constant at about 77 per cent. over a wide range of current densities. Professor Desch pointed out that the deposit is a solid solution of gold and silver.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS FOR NOVEMBER, 1920.

The official returns of our foreign electrical trade for the past month show very satisfactory totals, the export values of electrical material and machinery for November being £1,678,940, an increase of £357,688 over the previous month, and £293,146 more than the June, 1920, total of £1,385,794, the previous record figures. Nearly all the export items show increased values, the principal increase occurring in electrical machinery, £220,000, whilst higher export values are also recorded in electrical goods, £55,000; insulated wire, £86,000; glow lamps, £10,000; batteries, £9,000; and meters, £10,000; electric telegraph and telephone material and apparatus exports fell off to the extent of £20,000, and carbons, £13,000.

The electrical imports for November are lower by £47 000 than in the previous month, the total being £385,963; electrical machinery import totals recorded a falling-off of over £50,000, slightly increased values occurring in the imports of electrical goods and insulated wire.

The re-exports of foreign and colonial electrical material for the month at £18,546 are £4,000 less than in the previous month of October.

Values of Electrical Exports and Imports for November, 1920.

	Exports.	Imports.	Re-exports.
Electrical goods and apparatus (unenumerated)	£280,941	£106,519	£8,094
Insulated wire	398,187	23,546	29
Glow lamps	50,083	12,692	2,591
Arc lamps and parts	3,801	5,322	22
Batteries	80,557	22.518	—
Meters	41,059	12,704	1,340
Carbons	13,399	15,045	736
Electrical machinery:—			
Railway and tramway motors ...	2,419	—	—
Other motors and generators ...	216,198	—	—
Electrical machinery (unenumerated)	251,225	142,655	3,631
Switchboards (not telegraph or telephone)	20,497	1,191	—
Telegraph and telephone cable and material:—			
Telegraph and telephone wire and cable (not submarine)	130,596	9,537	—
Submarine telegraph and telephone cable	81,609	—	—
Telegraph and telephone instruments and apparatus	108,369	34,234	2,103
Totals... ...	£1,678,940	£385,963	£18,546

THE BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION (INC.).

Annual Luncheon.

On Friday last, after the annual general meeting of the Electrical Development Association, the annual luncheon took place at the Hotel Cecil. The President, Mr. Hugo Hirst, occupied the chair, and there was a large gathering of members and friends. Amongst the guests were Sir John Snell, Sir Harry Haward, Messrs. W. W. Lackie, A. Page, H. Booth, Ll. B. Atkinson, C. H. Wordingham, H. H. Berry, C. O. Bastian, Sir T. O. Callender, Messrs. R. A. Chattock, D. N. Dunlop, F. Espir, S. E. Fedden, H. C. Levis, C. H. Merz, H. Marryatt, J. R. Orr, G. Scott Ram, —. Gamage, Dr. A. Russell, Dr. R. M. Walmsley, and Ald. Walker.

After the loyal toast, the Chairman gave the toast of "Electricity, the Electricity Commissioners, and the Institution of Electrical Engineers." Remarking that he was usually an optimist, he said he could not help feeling that the prospects of development were not at present encouraging; they were passing through an industrial crisis, money was short, goods were short. Half the world wanted goods but could not afford to buy them; the other half was producing goods at a rate and a price for which only a limited market could be found, with the result that unemployment was rife. In a few months values had fallen 50 per cent., and men of substance were looking anxiously at the black clouds and wondering whether the storm would break. However, whatever happened, the world would go on, and electricity would play a large part in its reconstruction. Before the war it was left to the contractor to tell the public of the advantages of electricity; that could not continue. Manufacturers had entered the field, and their collective wares should be presented to the public by a duly qualified association. E.D.A. could instruct the public in the merits of electric lamps and heating apparatus, industrial motors, &c. He knew something of the British public; they would not carry the public with them if they conducted the propaganda on too low a plane. They must interest and fascinate the public, show it what a wonderful part electricity must play in future transport, explain how coal conservation and electricity went hand in hand, demonstrate the utility of water power, show how electricity would raise up industries in villages, assist agriculture, cheapen the cost of living, increase the yield of crops, and heal the sick. Let them appeal to the imagination—but they must not rely on engineers to do that; they needed men like Wells and Kipling to touch the imagination. There were other avenues for development, too; the Association could educate legislators, and improve the patent laws, which at present always worked against the patentee. In a recent case three judges of appeal agreed that an invention was meritorious, but quashed the patent on the ground of faulty wording. Industry was built up on patents, and some firms had started research departments, but meritorious inventions must not be sacrificed to technicalities—the inventor must have his reward. In coupling with the toast the names of Sir John Snell and Mr. Ll. B. Atkinson, Mr. Hirst said the Electricity Commissioners had been received with favour by the public, and the Institution this year had a President who was not only expert in science but also a leader in industry.

Sir John Snell, in reply, said the objects of the Association were the same as those of the Commissioners—the development of electricity; but whereas the former had complete freedom, the latter were shackled by the law. Their policy was to get into liaison with the important associations of the industry as directly as possible. They welcomed the formation of the Electrical Research Association. The Institution had helped them materially in redrafting the "Board of Trade Regulations," which would soon be completed. They had not yet had time to set up the Advisory Committees, but the associations were efficient substitutes. Since the appointment of the Electricity Commissioners in May loans had been sanctioned for 13 millions sterling, half of which sum was devoted to big power stations, such as those which had been designed by Mr. Pearce for Manchester at Barton and by Mr. Wordingham for Leicester. A sum of 4¼ millions had been applied to transmission and distribution, and 2¾ millions to extensions of small power stations, work which would not have been sanctioned if the Joint Authorities had been in existence—but it was unavoidable, if development was not to be brought to a stop. Anxious thought had been given to the question of increasing maximum charges for supply; all costs had gone up, and the pre-war charges had become inadequate. But under the Statutory Increase of Charges Act they were restricted to increases enabling the undertakers to pay only three-quarters of their former dividends, and under the Act of 1899 certain companies and all local authorities were unable to benefit. Those matters would be put right by the new Bill. The Commissioners felt that the well-being of the smaller undertakings especially depended on wise decisions regarding these applications, of which 200 had been received. Delays were caused, too, by the statutory necessity of publishing certain notices months in advance. They had provisionally determined 13 areas, and the inquiries would begin on January 11th. Not only the local authorities but also the companies had shown themselves willing to enter into schemes with enthusiasm, and the Commissioners had been able to inform the Ministry of Transport that compulsory powers could be dispensed with for a time, to give existing undertakers full scope for voluntary work. If, however, the schemes were not forthcoming, they would have to go to Parliament with good cause, and would secure the powers. A few small undertakings thought they could do better on their own, but there was no shadow of doubt that development on a big scale was the right thing for the industrial development of this country. The new Bill would enable Joint Authorities to borrow and their constituents to lend money, would provide for the revision of maximum charges at intervals of three years instead of five, and would enable railway companies with surplus power to supply the public by consent of the authorised undertakers. Electrification of the railways would be rapid when the financial situation improved, and would carry electricity supply into areas not now served. General co-operation of electrical interests throughout the country would help industrial development; electricity supply was undoubtedly a key industry, and they looked forward to ever-increasing co-operation with this most important Association.

Mr. Ll. B. Atkinson, also replying, referred to the eloquent and remarkable speech of the President, which, he felt sure, was uttered under a passing wave of pessimism. The Institution was one of the youngest of its kind, but was the most vigorous, the largest in numbers, and the most progressive that ever existed. Its interests covered an immense range, and its mysteries fascinated the lay mind, which was fond of the saying "Electricity is still in its infancy"—yet the public did not notice that "Gas was in its dotage." They also said that no one knew what electricity was; in point of fact, more was

known about electricity than most people knew about their own boots. Unfortunately, there was no electrical sense, so that the great public knew neither the extent to which electricity already entered into their lives nor how much it ought to enter into them. It was the function of E.D.A. to tell mankind all about electricity, which for half a century had been developed only in a half-hearted way. It must be brought into *every* house, as it was in Amsterdam, and E.D.A. would promote a vigorous propaganda to that end. They had a first-class commodity, and by forcing it on the consumer they would benefit him as well as themselves. Half the dullness, half the work, and half the dirt of life would be abolished if electricity were fully utilised.

Mr. A. F. Berry (Chairman of E.D.A.) proposed "The Guests," and welcomed the optimistic note of Mr. Atkinson. He asked the Press not to lead people to think that electricity was something to be afraid of. The Association had worked hard to spread the gospel of electricity. Mr. Gordon Selfridge was a good example of a man who used electricity all day and for everything.

Replying to the toast, Mr. Selfridge declared that Mr. Hirst was not really a pessimist. It was the duty of the Electrical Development Association to remove the conservatism that reigned in people's minds with regard to the necessity of using electricity freely in every way. Even some of the producers of electricity seemed to suffer from that spirit of conservatism. The Association would remove it by the power of publicity, with which, wisely directed, anything whatever could be achieved. He could imagine no more delightful undertaking than that of exercising the imagination in bringing home to people the fact that electricity was an absolute necessity to them all.

IMPORT TRADE OF AUSTRALIA.

The following figures, showing the values of the imports of electrical and allied goods into Australia in 1918-19, are taken from the recently published official trade returns. For purposes of comparison the figures for 1917-18 are given, and notes of increases or decreases are made. Only in the case of cables is it possible to indicate any unit other than value.

		1917-18 £	1918-19 £	Inc. or dec. £
Gas and oil engines.				
Total	... ...	100,000	141,000	+ 41,000
From United Kingdom	... ...	12,000	25,000	+ 13,000
,, Canada	... ...	9,000	10,000	+ 1,000
,, United States	... ...	77,000	106,000	+ 29,000
High-speed reciprocating steam engines (direct coupled).				
Total	... ...	3,000	1,000	− 2,000
From United Kingdom	... ...	3,000	1,000	− 2,000
Steam turbines, economisers, superheaters, &c.				
Total	... ... £	74,000	80,000	+ 6,000
From United Kingdom	... ...	69,000	74,000	+ 5,000
,, United States	... ...	4,000	5,000	+ 1,000
Dynamo-electric machines, static transformers, induction coils, electric fans and parts thereof.				
Total	... ...	277,000	501,000	+224,000
From United Kingdom	... ...	75,000	182,000	+107,000
,, United States	... ...	189,000	308,000	+119,000
Regulating, starting and controlling apparatus.				
Total	... ...	58,000	93,000	+ 35,000
From United Kingdom	... ...	23,000	26,000	+ 3,000
,, United States	... ...	35,000	66,000	+ 31,000
Electric fittings, viz., switches, fuses and lightning arresters.				
Total	... ...	50,000	112,000	+ 62,000
From United Kingdom	... ...	15,000	30,000	+ 15,000
,, United States	... ...	22,000	64,000	+ 42,000
,, Japan	... ...	12,000	16,000	+ 4,000
Electric heating and cooking appliances.				
Total	... ...	13,000	15,000	+ 2,000
From United Kingdom	... ...	6,000	7,000	+ 1,000
,, United States	... ...	7,000	8,000	+ 1,000
Electrical appliances, other.				
Total	... ...	233,000	421,000	+188,000
From United Kingdom	... ...	47,000	58,000	+ 11,000
,, United States	... ...	82,000	168,000	+ 86,000
,, Japan	... ...	34,000	54,000	+ 20,000
,, Netherlands	... ...	68,000	140,000	+ 72,000
Telephone apparatus.				
Total	... ...	57,000	81,000	+ 24,000
From United Kingdom	... ...	14,000	9,000	− 5,000
,, United States	... ...	42,000	70,000	+ 28,000
Accumulators or storage batteries.				
Total	... ...	49,000	119,000	+ 70,000
From United Kingdom	... ...	9,000	11,000	+ 2,000
,, United States	... ...	39,000	107,000	+ 68,000
Arc lamp carbons.				
Total	... ...	10,000	19,000	+ 9,000
From United Kingdom	... ...	3,000	1,000	− 2,000
,, United States	... ...	3,000	17,000	+ 14,000
Arc lamps, carbon in blocks, vacuum tubes, measuring and recording instruments, insulating tape.				
Total	... ...	48,000	143,000	+ 95,000
From United Kingdom	... ...	19,000	31,000	+ 12,000
,, United States	... ...	23,000	99,000	+ 76,000
Lamps and lampware.				
Total	... ...	114,000	176,000	+ 62,000
From United Kingdom	... ...	27,000	25,000	− 2,000
,, Japan	... ...	19,000	27,000	+ 8,000
,, United States	... ...	61,000	108,000	+ 47,000
Cable and wire, covered.				
Total	... ... Tons	920	4,000	+ 3,080
	£	181,000	612,000	+431,000
From United Kingdom	... Tons	150	825	+ 675
	£	24,000	147,000	+123,000
,, Canada	... ... Tons	3	450	+ 447
	£	1,000	49,000	+ 48,000
,, Japan	... ... Tons	600	1,700	+ 1,100
	£	124,000	293,000	+169,000
,, United States	... Tons	165	970	+ 805
	£	32,000	123,000	+ 91,000

WESTERN ELECTRIC TELEGRAPH AND TELEPHONE SYSTEMS.

(*Concluded from page 775.*)

The uniformity of the amplifying efficiency of a Western Electric repeater of the latest type is well shown in fig. 5. Curves A_1, A_2, and A_3 show typical gain characteristics, as a function of frequency, for three adjustments—high, medium, and low amplification. "Miles gain" represents miles of standard cable for a frequency of 800 cycles. The curve is almost flat between 135 and 2,600 cycles, and its shape is practically the same in each case—a very important matter, as 10 to 20 sets may be connected in tandem. Fig. 6 shows the repeater element.

The demonstration was designed to show the two chief

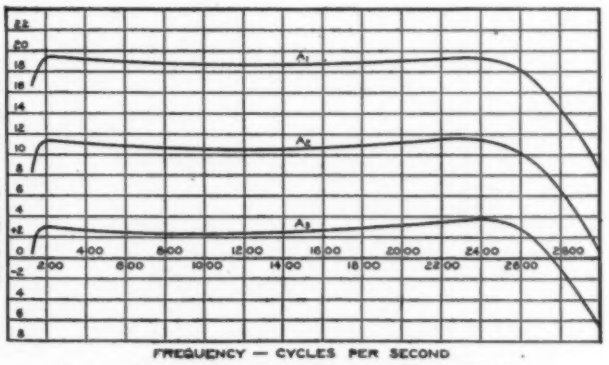


Fig. 5.—Typical Telephone Repeater Transmission Characteristics.

types of repeater and terminal equipment involved in long trunk cable and aerial systems, *i.e.*, the 22-type (2-element, 2-way repeater for 2-wire use) and the 4-wire equipment. Artificial lines were used which attenuated the transmission by amounts corresponding to average practice in the spacing of each type of repeater.

The 2-wire repeaters were of the 22-type, similar in design to those which have recently been installed on a non-loaded aerial No. 8 B.W.G. (435 lb. per mile or 4.2 mm.) line between New York and San Francisco. Twelve of these repeaters are employed on this backbone route, and of course others are used when the circuit is extended appreciably at either end.

The demonstration circuit was terminated at each end with a local battery set. The first section of line had an equivalent of five standard miles, leading to the apparatus used in a long-distance central office; from this there was a line, equivalent to seven standard miles, to the first repeater. Between the repeaters there was a line of 14 standard miles, and beyond the second repeater the make up of the circuit was similar to that leading up to the first. The repeater sets were adjusted to give 12 standard miles gain each, in both directions. This was possible because of the good balance between line and network which could be obtained with artificial lines, and corresponded to an equivalent between testboards at the ter-

minals of only four miles. Higher gains might easily be obtained, but they would bear no particular relation to practical conditions. The sets were capable of giving about 22 miles gain at their maximum adjustment. A figure considerably below this is usually adopted in deciding on the location of repeaters.

The repeater sets were of the panel type, designed to be mounted in relay rack bays, as shown in fig. 7. An adjacent demonstration rack contained the monitoring and talking panel, and the signalling panel, which was specially arranged for the demonstration with the various kinds of equipment necessary to illustrate three types of signalling: 16-cycle relayed, 135-cycle relayed, and 135-cycle amplified. One panel of testing equipment was shown which included such apparatus as might be common to a large group of repeaters, namely, the motor panel for testing the power supply voltages

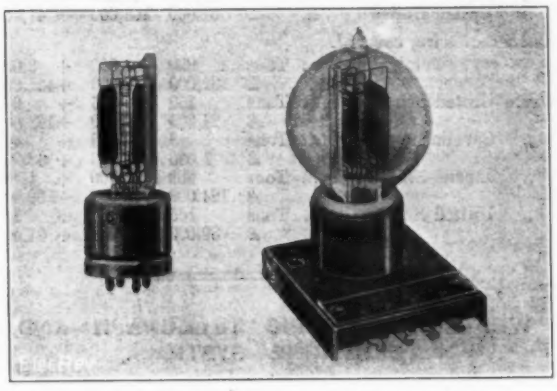


FIG. 6.—VACUUM TYPE TELEPHONE REPEATER ELEMENT, WITHOUT BULB, AND COMPLETE.

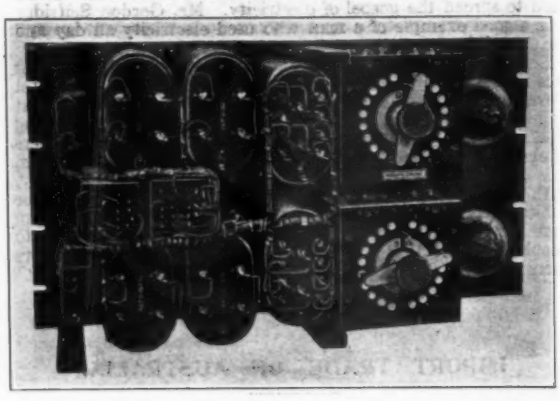


FIG. 7.—THROUGH-LINE VACUUM-TUBE TELEPHONE REPEATER SET (2-WIRE CIRCUIT).

and currents, two types of gain-measuring equipment, and a vibrator for supplying 135 cycles for signalling.

Special mention should be made of the indicating type of gain-measuring set (fig. 8). This set will measure (with a suitable auxiliary speech-frequency oscillator) the actual amplification introduced by a repeater set between two artificial lines to an accuracy of ¼ mile. An amplifier-rectifier is employed whose output is recorded on a small indicating galvanometer. This amplifier-rectifier has its high impedance input thrown alternately across certain resistances in the input and output artificial lines by a quick-acting switch. The attenuation of the input artificial line is varied by adjusting dials controlling shunts, and when this added attenuation is neutralised by the repeater gain, the deflections in the two positions of the switch are equal, and the gain is read directly from the dial settings. Gains at any frequency from 100 to 30,000 cycles and of any magnitude from 0 to 46 miles may be measured. The set may be used with either two-wire or four-wire repeaters.

The four-wire repeater sets were similar in design to those employed in the United States for four-wire trunk cables of moderate length. Such cables are generally loaded with medium coils (.175 H.), on heavy spacing (6,000 ft.). Starting from the local battery set, the circuit led through a 2-wire line of 5 standard miles equivalent, to the 4-wire terminating set, with an additional loss of 3 miles. This set served to transform the circuit from 2-wire to 4-wire, and also to change the local 16-cycle signalling to the 135-cycles used on the long-distance cable. From this, on the outgoing side, the line went through 15.5 standard miles equivalent to the input of the first one-way amplifier, which was set at 34 standard miles gain; then through 31 standard miles equivalent to the second repeater, adjusted to give the same gain as the first. From the output of this amplifier the circuit led through 15.5 standard miles to the 4-wire terminating set at the far end, and finally over a short 2-wire line of 5 standard miles to a local battery set.

With these gain settings the equivalent of the 4-wire circuit proper between the 2-wire lines was practically zero. With good balance against the 2-wire lines, short 4-wire circuits may actually be used to give a gain in transmission.

Arrangements were also provided for connecting the two systems in tandem, so as to talk through two 2-wire and two 4-wire repeaters, six tubes in all. The two systems were switched together at the points normally connecting to the local battery sets, and on account of the long length of line between the adjacent 2-wire and 4-wire repeaters the gain of the 2-wire sets was increased to 16 miles each. The total line equivalent was then 110 standard miles, and the net equivalent of the circuit with repeaters was reduced to about 17 miles between subscribers' sets.

On trunk circuits enormous economies are possible by the use of repeaters, and on the longest circuits commercial transmission would be impossible without them. On trunk circuits of moderate length, commercial speech transmission is obtained with the aid of repeaters, on conductors having only a small fraction of the copper that would otherwise be required. With regard to the present possibilities of wire communication, it is stated that the repeater makes it possible to talk to any earth distance where land lines can be installed.

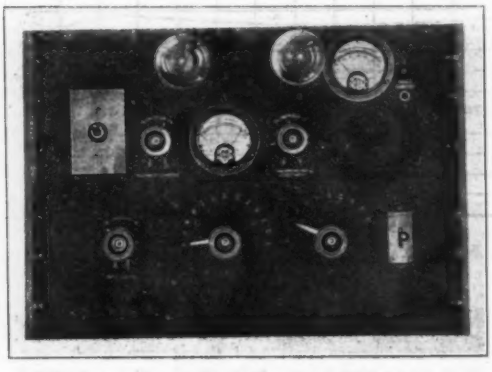


FIG. 8.—METER TYPE TRANSMISSION GAIN MEASURING UNIT.

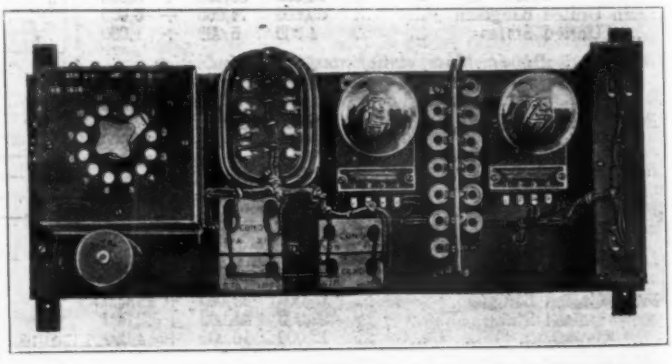


FIG. 9.—THROUGH-LINE VACUUM-TUBE TELEPHONE REPEATER SET (ONE-HALF) FOR ONE WAY OF ONE 4-WIRE CIRCUIT OF LOADED CABLE.

The whole of the demonstrations, both telegraph and telephone, were exceedingly interesting, and the results obtained bore out the statements made by the engineers by whom they were carried out. The contrast between the faint, hardly audible speech over the long artificial line without amplification, and the strong clear speech which came through, directly the repeaters were switched into circuit, was very impressive. Perhaps the most striking observation was the fact that these apparatus were clearly not in the experimental stage or subject to rule-of-thumb methods; *accurate measurement* was the key-note throughout, demonstrating the fact that telephone repeater systems had been established on a sure scientific basis, and that the results that would be obtained were as certain as the methods by which they were secured.

We believe that the apparatus will remain installed in London, and can be seen on application to the company.

THE WEST OF ENGLAND ELECTRICITY AUTHORITY.

Whereas Section 5 of the Electricity (Supply) Act, 1919, has enabled the Electricity Commissioners to provisionally delimit thirteen electricity districts for the purposes of the Act, no Joint Electricity Authority has as yet been constituted for any of the districts, although a number of schemes for the formation of such authorities have been prepared.

The first area to be provisionally constituted a separate electricity district was that known as the West of England, or Lower Severn, District. On January 11th next the Electricity Commissioners are to hold a local inquiry at Bristol with reference to the area to be included in the proposed district, and to consider a scheme which has been submitted for effecting an improvement in the existing organisation for the supply of electricity in, and the formation of a Joint Electricity Authority for, the district.

The scheme to be submitted for the approval of the Commissioners provides that the Electricity Authority shall consist of representatives of any or all of the authorised undertakers, county councils, local authorities, and such companies, bodies, or persons being large consumers of electricity, within the district. The voting rights of a local authority shall be retained notwithstanding the transfer of all or part of its undertaking or purchase rights to the Joint Authority. A company loses its voting rights when it ceases to be an authorised undertaker exercising rights in the district.

If the rights to purchase the whole or part of the undertaking of *any* authorised undertaker is at any time transferred to the Electricity Authority, such undertaker shall have voting rights as from the date of such transfer.

The county councils shall appoint three of the members of the Electricity Authority and the rest of the members shall be appointed *pro rata* with the number of units of electricity sold per annum within the area of supply of the local authority, company, body, or person, and shall include the units used by local authorities for street lighting, tramways, and similar purposes.

Any two or more local authorities, companies, bodies, or persons may aggregate the units so sold, and agree on the exercise of the voting power thus secured.

Every member of the Electricity Authority (other than a member appointed by the county councils) shall have one vote only upon any question, and members appointed by county councils shall have a similar vote when the council or councils appointing them assumes financial responsibility commensurate therewith. In case of an equality of votes the chairman shall have a second or casting vote.

The persons first appointed members of the Electricity Authority shall hold office for a period of three years from January 1st next following the date of the approval of this scheme, at the expiration of which term the voting power for the appointment of members shall be again ascertained, and the same shall be so re-ascertained every six years thereafter. Members of the Electricity Authority may be members, officers, or servants of any county council, local authority, company, or otherwise. No person other than one who has his usual place of residence or place of business within the district shall be appointed a member. All members shall hold office for a period of three years. Ten members shall constitute a quorum at any meeting of the Electricity Authority.

The Electricity Authority shall have, and may exercise, all powers and duties as are or may be conferred upon a Joint Authority by the Electricity (Supply) Acts, 1882 to 1919 (?), and may, with the consent of the Electricity Commissioners, borrow money for any purpose, which money, and the interest thereon, shall be a first charge either on the whole or part of the property, real and personal, which is vested in the Electricity Authority at the time at which the money is borrowed, or on the revenues of the Electricity Authority. The Electricity Commissioners may, for the purpose of enabling the Electricity Authority to raise money, authorise the Electricity Authority to issue stock bearing interest. The Electricity Authority may, instead of borrowing money on mortgage or issuing stock, issue and renew bills and bonds.

The total amount of any such bills outstanding at any one time shall not in the aggregate exceed the sum of one million pounds, except by the amount payable on bills issued shortly before any other bills fall due in order to pay off those bills.

The Electricity Authority may obtain temporary loans, provided that the total amount so advanced and outstanding at any one time shall not exceed one million pounds or such larger sum not exceeding two million pounds as the Electricity Commissioners may sanction.

For the purpose of defraying expenditure on capital account the Electricity Authority may, instead of raising moneys, employ any moneys for the time being standing to the credit of any sinking or redemption funds established under this scheme. No such moneys shall be so employed unless provision is made for securing that any deficiency (including loss of interest) occasioned in any such fund by reason of so employing such moneys shall be made good at the date (if any) on which such moneys are required for the purpose in respect of which they were originally provided.

Any authorised undertaker whose area of supply is wholly or partly within the district of, and any authority, company, or person receiving or intending to receive a supply of electricity from, and the council of any county or borough or county district wholly or partly within the district of the Electricity Authority, shall have power to give financial assistance in any form to the Electricity Authority on such terms, including the payment of consideration for the assistance given, and subject to such conditions as the authority, company or person giving such financial assistance thinks fit. Provided that in the case of the council of a county or borough or county district, whether or not the council is an authorised undertaker or receives or intends to receive a supply of electricity from the authority, such powers as aforesaid shall not be exercised without the consent of the Minister of Health.

The Electricity Authority may at any time enter into an agreement for the immediate surrender or transfer of any right vested in any local authority (including a county council) to purchase the whole or part of an undertaking; the terms of such agreement shall be subject to the approval of the Commissioners.

If the Electricity Authority is satisfied that its receipts on revenue account in any year are likely to be insufficient to meet the charges payable out of revenue the deficiency shall be apportioned amongst the county councils, local authorities, companies, bodies, or persons entitled to appoint representatives upon the Electricity Authority in proportion to their voting power.

The Electricity Authority shall consist of 30 members, provided that the number shall not be altered unless agreed by a special resolution carried by a majority consisting of at least two-thirds of the members of the Electricity Authority having voting power, and shall be subject to the approval of the Commissioners. The chairman may be paid such remuneration for his services as the Electricity Authority may determine, and shall (if the Electricity Authority by resolution also so determines) be deemed to be an officer of the Electricity Authority entitled to the receipt of a pension or gratuity on retirement. The Electricity Authority may appoint officers and servants, and they shall be paid salaries and remuneration, and on retirement pensions or gratuities, as the Electricity Authority may determine, and any expenses incurred by the Electricity Authority in the exercise and performance of its powers and duties may be defrayed out of the fund established under Section 28 of the Electricity (Supply) Act, 1919. The Electricity Authority may delegate with or without restriction to committees of the authority any of the powers or duties conferred upon it, and may pay out of the revenues of the authority travelling and subsistence expenses of members of the authority, and reasonable compensation for loss of remunerative time.

In this scheme the schedule to the Electric Lighting (Clauses) Act, 1899, shall be incorporated subject to certain exceptions and modifications.

The prices charged for electricity shall be fixed by the Electricity Authority and subject to the approval of the Electricity Commissioners. The voting power for the appointment of members of the Electricity Authority other than members appointed by county councils shall be one vote for every 50,000 units of electricity sold per annum up to 500,000 units (ten votes); then one vote for every 55,556 units sold up to 1,000,000 (19 votes); then one vote for every 62,500 units sold up to 1,500,000 (27 votes); then one vote for every 71,428 units up to 2,000,000 (34 votes); then one vote for every 83,334 units sold up to 2,500,000 (40 votes), and for each additional 100,000 units one additional vote, provided that no single body or pooled votes shall be entitled at any time to exercise voting power in excess of 45 per cent. of the votes held by all other bodies.

LEGAL.

An Electricity Supply Contract. Application to Annul.

In the Chancery Division, on December 16th, Mr. Justice P. O. Lawrence delivered his considered judgment upon the application of the North Metropolitan Electric Power Supply Co., Ltd., for an order annulling four agreements for the supply of electric power to the Stoke Newington Corporation. The case was reported in our issues of November 26th and December 10th.

The agreements, said his Lordship, were dated December, 1904, January, 1906, March, 1908, and October, 1911; three had to be considered, that of 1908 being immaterial so far as regarded the question at issue. The agreements might be determined by the Corporation, but the company had no power to determine them. The company alleged that they were now making a heavy loss instead of a profit, and that the agreements could not be enforced without serious hardship to them. They further alleged that this loss had been brought about owing to the alteration of trading conditions occasioned by the war, and they asked that the agreements be annulled. The company had proved that the price of coal and wages had risen, and they contended that these rises made it impossible for them to manufacture the energy except at a heavy loss, and that this constituted an alteration of trade conditions within the meaning of Section 1, Sub-section 1, of the Courts Emergency Powers Act, 1919. The Corporation did not dispute that the rise had taken place, but they

denied that it came within the meaning of the section. His Lordship held that the rise in the cost of coal and wages had brought about an alteration in the trading conditions under which the company manufactured and supplied electrical energy.

The next question was whether this alteration had been occasioned by the war, and he was assisted in that by the evidence of Mr. Gilbert Stone, on behalf of the Corporation, who had proved that the rise in the price of coal was occasioned by the war. But Mr. Jenkins, for the Corporation, had argued that although the rise might have been caused by war conditions, yet these obstacles had all been removed, and the price of coal and labour was still on the up grade; it could not, therefore, be said that the alteration of trading conditions was due to the war. There again the affidavit of Mr. Stone afforded the answer, viz., that the purchasing power of the pound had fallen owing to the war, and that this was really the main cause for the demand for higher wages and for the high prices. In his Lordship's opinion the depreciation in the purchasing value of money and the alteration of trading conditions which the country was now experiencing was caused by the war within the meaning of the section. The third question was whether, owing to the above, the agreements in question could be enforced without serious hardship on the company. His conclusion was that although there was great force in the Corporation's contention that Mr. Murray had placed the actual annual loss of the company at too high a figure, yet the only practical way in which the company could ascertain whether the manufacture and supply of a given quantity of electricity to their customers was being carried on at a profit or loss was by attributing to the energy supplied to those customers the proper proportion of the total cost. If the company were to be held bound by the agreements he held that they could only supply the energy at a heavy annual loss.

Mr. Jenkins's contention that the scale of charges agreed to by the company was the result of cutting the price owing to competition, that the price was deliberately fixed by the company at such a low figure, and as a result the company were inevitably bound to suffer a loss, and that any hardship in this respect was not caused by an alteration of trading conditions, but by the company having agreed to too low charges was not borne out by the evidence, which also showed that Mr. Murray was right in ignoring the cost of the Hackney supply in calculating the cost.

In his Lordship's judgment, the heavy pecuniary loss of the company in carrying out the terms of the agreements, which agreements they were unable to determine, amounted to a serious hardship within the meaning of the section, and, therefore, the Court had the jurisdiction to annul the agreements in question. He proceeded to consider whether the Court ought to exercise that jurisdiction in the present case, but he could not help feeling much embarassed by having to exercise so arbitrary a power. It was an emergency power conferred owing to the great dislocation in commercial transactions caused by the war, and it was obvious that under the jurisdiction thus conferred it would be highly inexpedient to lay down any general principles upon which the Court should act in all cases; he did not intend to do any such thing. The parties not having agreed to the agreements being amended, the question was whether the Court should annul the whole of them. Having come to the above conclusion, he conceived it to be in accordance with the spirit of the section that the Court should annul the agreements unless the circumstances of the case, or the position of the parties, should afford some good reason to the contrary, or unless the company were proved to be unreasonable in not accepting the offer of the Corporation to vary the agreements. Both parties were public bodies; and the Corporation were under a statutory obligation to supply sufficient electricity to customers, and the minimum price they were authorised to charge was fixed. The charge they made had, generally speaking, remained unaltered during the war—although in most of the other metropolitan boroughs there had been a large increase—and it was still much below the price that they were entitled to charge. On the annulment of the agreements the Corporation would be entitled to demand from the company, and the company would be bound to give, a sufficient supply at a price to be fixed; there was, therefore, no question of the Corporation being left at the mercy of the company.

Turning to the position of the company, his Lordship said that the Legislature had recognised that the undertaking was one of public and local advantage, and had conferred large powers on them, but it had also imposed on them certain obligations. He doubted whether, in considering the hardship on the company if the agreements remained in force, he ought to take into consideration any profits derived from other sources. The supply of electricity was a matter of public and local importance, and it was essential that the company should be able to earn sufficient profits to induce investors to take up capital in the concern, otherwise the company would soon find itself in difficulties. Judged from that standpoint it appeared to him that during the last two years the profits of the company had reached a dangerously low level, and any contract which was to decrease those profits must necessarily jeopardise the position of the company. He was of opinion that the Corporation's contention on that head failed.

There remained to be considered the company's offer, made on February 19th, 1919, to vary the agreements by inserting a coal clause, which provided for a variation in the rate of charge per unit in accordance with the rise or fall in the price of coal. That offer had never been withdrawn up to the present time, but the Corporation had not accepted it, nor had they commented on it in any way, and at the hearing it was definitely declined by Mr. Jenkins. On the evidence before him he did not think that the company was unreasonable in refusing the counter offer that was made, viz., a payment of £372 per annum, being half of the deficit of £744, which would be inadequate.

Finally, his conclusion was that the company had made out a case for the annulment of the agreements in question. There would be an order to the effect that the agreements be annulled as from the date of that order, but if the Corporation desired it he would stay the operation of the order to give them the opportunity of taking the case to the Court of Appeal. If they decided not to do so he would stay the order so that they could have an opportunity of obtaining a supply elsewhere if they thought it desirable. As regarded the costs of the application, the attitude taken up by the Corporation was not unreasonable. As a public body it was their duty to look after the interests of the ratepayers and consumers; relief ought to be granted only on the condition of the company paying the costs of this application, and he made an order accordingly. He stayed the operation of the order until the first day of the Easter sittings, the Corporation undertaking to pay on the basis of the coal clause in the meantime.

What is a Reasonable Profit?

Before Mr. Justice Acton, in the King's Bench Division, on Tuesday last week, the Electrical Contracts and Maintenance Co., Ltd., of Tothill Street, Westminster, were plaintiffs in an action against Mr. O. P. Davies, proprietor of the Hotel Somerset, Orchard Street, W. Plaintiffs sought to recover £141 12s. 4d., balance of account for work done at Hotel Quebec, Bryanston Street, W.

Mr. Croom-Johnson was counsel for the plaintiffs, and Mr. Hawke, K.C., and Mr. Bray appeared for the defendant.

Mr. Croom-Johnson said that the point to be decided was what was the true construction of the contract, and whether a certain charge which had been made for establishment charges and profit was either within the terms of the contract, or, otherwise, fair and reasonable.

Mr. J. J. Leyland Newlands, a director of the plaintiff company, said the work related to the installation of electric light and bells, and the charges were in accordance with plaintiffs' usual scale.

Mr. Leonard G. Tate, secretary of the National Electrical Contractors' Trading Association, gave evidence, stating that he considered the addition of 15 per cent. for establishment charges and 25 per cent. for profit fair and reasonable.

Mr. F. C. Gibbons, accountant, said he had audited the accounts of the plaintiff company, and the establishment charges for the year ending December 31st, 1918, amounted to 43 per cent. Cross-examined, witness said that during 1918 plaintiffs were unable to do sufficient trade to clear establishment charges.

Mr. Hawke submitted that a profit of 10 per cent., plus 10 per cent., was a generous one in substantial undertakings.

Mr. John D. Scott, architect, of Bedford Row, who supervised the work on behalf of the defendants, said that at the time of the contract an ample percentage would have been between 5 and 10.

His Lordship described the case as a lamentable one—lamentable because the amount involved was entirely out of proportion to the labour, ingenuity, and expense lavished upon it. He had come to the conclusion that 15 per cent. was a reasonable charge for establishment charges and that 25 per cent. was a reasonable profit in work of this kind. He accordingly entered judgment for the plaintiffs for £44 5s., judgment having already been given for £92.

Theft by Finding.

Simon Park, 26, an electrician, was charged on remand at the Guildhall, on December 14th, with stealing by finding a Bank of England note for £100. The defendant admitted he had found the note and had made no effort to trace the owner. His father had made restitution, and he was bound over in £50 to come up for conviction if called upon within the coming six months. The £100 note was lost in February last, and Park was arrested at the Bank of England on the 4th inst., when he attempted to cash it.—*The Times.*

Additional Factory Inspectors.—The Home Secretary is about to appoint two additional Electrical Inspectors of Factories to undertake electrical inspection under the direction of the Senior Electrical Inspector of Factories. The scale of salary, exclusive of war bonus will be £400 per annum, rising by annual increments of £20 to £650 per annum. The war bonus at present payable on the initial salary is £326 odd. The appointments will be for five years certain (subject to a year's probation), and will be capable of renewal at the expiration of that period. Responsible experience in large modern extra high-tension electricity supply undertakings will carry special weight.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

A Curious Phenomenon.

The curious phenomenon observed by your correspondent "J. Knowles Hassall," is probably due to acoustical and not electrical causes. The sound produced by the telephone bells would appear to be such as to cause resonance at the gas burners, the dimensions and general conditions of which would seem to be just right for producing the phenomenon called the chemical harmonicon. This phenomenon was investigated by Prof. Tyndall, many years ago. The results of his experiments were published in his "Lectures on Sound."

Your correspondent will probably find that, if he muffles the bells, the gas pressure will be no longer affected by the telephones. On the other hand, if he strikes the bells with a piece of metal he will possibly cause the lights to jump or flicker. I would like to suggest to your correspondent that earth wires should not be connected to gas pipes.

T. A. Robertson.

Glasgow.
December 15th, 1920.

Power Factor.

The recent discussion on power factor has served to draw attention to the question, and it has, therefore, served a good purpose. Mr. Stubbings has dealt adequately with certain of the points raised and I do not propose to add to his statement.

My first article dealt with the problem of explaining power factor to business men but as it became clear that there was a good deal of diversity of opinion among electrical men as to what power factor really is, I wrote at some length, endeavouring to explain it in a simple manner. I have the opinion of good authorities that the explanations given were satisfactory, and trust that some readers have found them of service.

The banking analogy has come in for criticism. Some critics appear to have expected too much from an analogy, but really an analogy can be good without covering every point! My idea of a conversation between a salesman and a business man is somewhat like this: The salesman explains that more money must be charged for current at low P.F., although the meter does not register anything extra. The business man asks why he should be expected to pay for current which he does not use. To this the salesman points out that the business man pays large cheques into his banking account and draws the money out shortly afterwards, or it may be the same day, and the banker charges for such accommodation, even if the payments into the account balance the withdrawals.

"Quite so," says the business man, "the banker charges for turnover because he requires a staff of clerks and incurs expenses to deal with the money, even if I do not have an overdraft."

"And," says the salesman, "if you have motors which take from our mains far more current than they need and then return the surplus energy to our system, like the banker, we must incur expenses for the accommodation. It is true the meter credits you with the current returned to the system, but we have had to enlarge our system to deal not only with the energy which you consume, but also with the energy which you draw out of the mains and pay back again. It is like the cheques which you pay into the bank and draw out soon afterwards to pay your expenses."

"Then," says the business man, "can I not do anything to reduce this current which oscillates to and fro between my motors and your system which you say would not be required if I had a different type of motor?"

The salesman has gained his point, and can now drop the analogy and quote for apparatus which will reduce the wattless, or oscillating current. Whether this be condensers, or the installation of over-excited synchronous motors, or some other method, must depend on circumstances. It is the business of the salesman to put forward his case, and if the cost of such apparatus be too great, then the buyer of electricity must be prepared to pay the extra cost of supplying him with current of low power factor. I have put the suggestion before men who have had great experience in dealing with business men, and they have approved of it. Of course, tact and some pains are required to make an explanation acceptable on these lines, but I do not doubt that they will be forthcoming among the technical-commercial staff of our electric power authorities.

Once more let me quote from "Glover's Calendar." The editor appears to have foreseen this discussion, and has put in several items which illustrate the points in an admirable manner. Under date November 17th he says:—

"In one large manufacturing plant it was found on an engineering survey of the motor ratings and loads that the induction motors were in most cases at least 25 per cent. too large, and in some instances 150 per cent. larger than necessary. The average of the tests showed 37 per cent. excess capacity in motors. . . . The power factor of the shops was 60 per cent. The motors were found to be working under average loads of about 30 per cent. of their normal capacity, with an average motor efficiency of about 79 per cent. Had the motor loads averaged between half and full load, the efficiency would have increased to about 86 per cent. and the power factor would have increased to 78 to 88 per cent. At the time of the tests very little had been done towards installing synchronous motors to improve the power factor."

The state of matters outlined here is by no means uncommon, and I think is sufficient to show that it is not possible to solve the problem satisfactorily by estimating the power factor in advance, as has been suggested by some correspondents.

C. Turnbull.

Electricity Works, Tynemouth.
November 17th, 1920.

The Severn Barrage.

I notice that in its third interim report the Water Power Resources Committee still refrains from giving any estimate of the capital cost of the Severn estuary scheme. As interest and depreciation will constitute the greater part of the power cost, I fail to see why it should decline to give the estimated expenditure on which the estimated cost of generation is based.

W. M. Sandison.

Warrington.
December 15th, 1920.

The Position of the E.S.C.A.

April 1st, 1920.—*All Fools' Day.*—The date settled upon by the National Joint Board for payment of the salaries to the commercial and clerical staffs, according to its recommendation. The commercial and clerical staffs realise what a most appropriate day this was, and are now waking up to the fact that the joke has gone far enough.

The country is crying out against heavy taxation and rates, unemployment, &c., and the people managing electrical affairs find this a very suitable argument to use against the poor commercial man, who is struggling bravely to keep up some semblance of decency. If he contrives to save a few pounds for a short annual holiday, it usually happens that he decides to pay his proportion of the rates and taxes, and stays at home.

I agree with "Outdoor Representative's" letter published in your issue of the 10th inst., that members of the E.P.E.A. would cease to exist to some extent if consumers were not "obtained" and "retained" by the commercial side of the undertaking.

Further than that, if the necessary oils, waste, fuel, &c., were not ordered or accounts were not promptly dealt with and settled a great deal of trouble would arise. One can also imagine what would happen if the hourly-paid worker was told on payday that owing to the office staff being on strike no wages had been made up for him. Now, members of the E.P.E.A., just bring pressure to bear upon your representatives with a view to arriving at a working agreement with the E.S.C.A.

The majority of the E.P.E.A. are now in receipt of the demands recognised by the same National Joint Board that decided the E.S.C.A. schedule, and it is to be hoped that the appeal for alliance will not fall on deaf ears.

The employers' side of the National Joint Board have not carried out their part of the compact, and great unrest and dissatisfaction has resulted. Members of the E.S.C.A. should resign from all local guilds as the National Association of Local Government Officers will claim the right to represent their interests unless they do. Their unswerving support and every ounce of their strength are required if they expect to obtain the reward they are entitled to.

The E.S.C.A. is adopting the same attitude to timekeepers and storekeepers that it is condemning the E.P.E.A. for, and a section ought to be formed taking those in who are occupying responsible positions, as this is a class that has no proper representation at present. Commercial staffs in tramway undertakings who are separated from the light and power department should also be invited into the E.S.C.A., for remember that "unity is strength," and snobbery amongst our representatives must not be fostered.

Fair Play.

December 15th, 1920.

The Salaries of Works Engineers.

Attention is at present focused on the E.P.E.A. question of salaries, which has drawn a surprisingly sympathetic attitude from the technical Press. It seems, however, to escape the notice of the technical Press that the conditions of employment of trained engineers in manufacturing and contracting firms will, by settlement of this matter, be thereby shown up in sorry contrast. The writer was a shift man until some years ago, when not being satisfied with prospects, which point of view will be fully appreciated, he with considerable difficulty entered the manufacturing end, and now finds that his position would have been considerably improved had he

remained in central station work. To put it briefly, the manufacturing end offered better conditions and prospects as compared with central stations a few years ago, whereas now the reverse is notoriously the case. What is required is an organisation of, say, trained engineers in the employment of B.E.A.M.A. firms on similar lines to the E.P.E.A., or some such collective steps, so that conditions of employment in the respective branches of the electrical industry may be to some extent equalised. Who will take the lead? and would the technical Press be equally sympathetic in a crusade against joint-stock companies as against (mostly) municipalities?

Testbed, A.M.I.E.E.

[If our correspondent read the technical Press more closely he would know that his question was superfluous; the Press will stand for justice, as it always has done. His inattention to our pages is further evidenced by his suggestion that an organisation be formed to protect the interests of the engineers on works' staffs; has he never heard of the Society of Technical Engineers, of which Mr. Norman Wyld is the secretary (102, Belgrave Road, S.W. 1)? It is true that the Society has not as yet taken a prominent part in affairs; but it holds the field, and will no doubt make its influence felt when its organisation is complete.—Eds. Elec. Rev.]

German Competition in the Electrical Trades.

You are quite correct in stating that "Germany is making another bid for the manufacturing trade of this country," and you might have added "of the world"; but we cannot stop this by Acts of Parliament!

Germany has to pay her war debts, and the more she sends to us as our share the better. By "us" I mean the nation, for we are not all makers of things electrical; and let us face the facts—not go about whining.

If our manufacturers cannot hold their own in the home market, how can they hope to compete successfully in the world markets? Every mother's son of us must work harder and produce better and cheaper stuff than the Germans are offering, or we "go under."

The first things to abolish are "rings," by which prices are now being kept up with the idea of protecting our industries, whereas the actual result is that they are killed.

W. H. M.

December 18th, 1920.

The Jurisdiction of the Electricity Commissioners.

Your "Legal Contributor" does not quite see my meaning, probably my fault. The words he used are capable of the interpretation that the Commissioners have no power to oblige a Joint Authority to supply a particular area. That seemed to need correction. It is clear that the Commissioners have general powers to impose such an obligation. Whether the limitations to which this power is subject do or do not apply in the case which was under discussion seems to be the essential point which your contributor omits to argue. With respect to consent of the power company, the proviso to sub-section (1) of section 12 enables the Ministry of Transport on the recommendation of the Commissioners to dispense with that consent. So that the contingency of some part of an area being left without a supply because the authorised undertakers or power company cannot or will not supply, and will not consent to the Joint Authority supplying, can hardly arise, assuming that there is a genuine demand in the area.

As to the "general" character of the schedule to the Clauses Act of 1899, that schedule is, in effect, a "Model Order." The passing of the Act did not make that schedule general law for all supply undertakings, or for any particular undertaking. It does not apply to any undertaking authorised by Orders or special Acts made before October 1st, 1899. And as to Orders and special Acts since that date, Section 1 of the Clauses Act expressly permits of variations or exceptions in the schedule as incorporated in such Orders or Acts. It is therefore not safe to quote the schedule as if it were general law applying to all undertakings. It only applies so far as it is incorporated in the Act or Order authorising a particular undertaking. I agree that most of the clauses of the schedule have been incorporated in the Orders or Acts passed since the date of the Act, but there are numerous exceptions. It is particularly unsafe to assume that any clause in the 1899 schedule is contained in an Act or Order of earlier date than 1899. There may be some technical term for an Act of this kind, which only becomes operative by incorporation, or partial incorporation, with subsequent Acts; in my ignorance I can only say that it is not exactly a general Act.

Henry M. Sayers.

London, S.W.
December 18th, 1920.

Shop Displays.

I am very much interested in the letters which have been appearing in your columns signed by "Retailer" and others, and I certainly think that it is time some steps were taken to protect the interests of contractors on much broader lines than the E.C.A. has hitherto been able to bring about, and generally to raise the status of contractors.

"Retailer" suggests the contractors being brought together in London and organising a real live Association. I do not, however, think that a new Association is really necessary. What is wanted is for the present Association to "get a move on," and thus increase its sphere of usefulness and largely extend its scope. My suggestion, therefore, is an appeal to the Contractors' Association to call general meetings in London and in all the large industrial centres, such as Manchester, Birmingham, Glasgow, Newcastle-on-Tyne, &c., these meetings to be thrown open to all *bona-fide* electrical contractors, and held in each centre simultaneously. I feel sure that the opinions ventilated at these meetings would result in the E.C.A. enormously increasing its membership, and putting the Association upon such a footing as would be a real benefit to the trade.

Among the chief points to be considered, in my opinion, are:—

1. The registration of all electrical contractors by the local supply authority.
2. Negotiations with the manufacturers and wholesale houses for a proper understanding regarding trade terms, and to whom such trade terms are to apply.
3. A properly organised advertising scheme to appeal to users to deal only with registered contractors, both for wiring work and the supply of electrical goods.
4. The Association to combine in making a dead set against the "private firms" which offer trade terms to all and sundry.

I feel sure that the aims of the Association would meet with the approval and hearty support of all supply authorities and wholesale suppliers, and the result would be to the benefit of all concerned, including the consumers themselves.

I think that our thanks are due to "Retailer" and your other correspondents for bringing the subject forward, and to you, Sirs, for your cordial support, and it now remains for the E.C.A. to justify its existence or leave it to us to start a new organisation.

R. Marshall Carr.

Macclesfield.
December 18th, 1920.

With reference to the correspondence under the heading "Shop Displays," my Association is constantly settling complaints as to trade discounts being incorrectly allowed, and when satisfactory settlement cannot be reached, strong action is taken.

The Association is always prepared to receive new members, and to investigate any instance of trade abuses. Full information both with regard to the Association and its work can be obtained by applying to me.

Leonard G. Tate,
General Secretary,
The Electrical Contractors' Association (Inc.).

London.
December 20th, 1920.

[Several letters have been received too late for inclusion in this issue.—Eds. Elec. Rev.]

"S. P. D." a Substitute for E.P.D. — Sir Charles Mandleberg, in a recent issue of the *Manchester Guardian Commercial*, made an interesting proposal for a substitute tax for E.P.D. Granting that a tax on profits is necessary in the first instance, he says such a tax should not be so great as to interfere with a regular flow of capital into industry. The simplest way would appear to be to impose a flat-rate tax on the net profits of all concerns, public and private, after providing for a fixed percentage on capital employed; with a proviso that reserves and undistributed profits at the beginning of a particular year should be treated as "capital employed" for the purposes of arriving at the total allowance on capital, and that remuneration for management, depreciation, &c., shall be deducted before arriving at the net profits.

Having regard to the difficulty of obtaining new capital, he says, the rate of interest to be allowed on the capital employed should not be less than 8 per cent. An authoritative estimate of the country's trading profit for 1920 made recently puts the figure at £546,000,000, or 13 per cent. on a capital of £4,200,000,000. On this basis there would be £210,000,000 that could be subjected to the surplus profits tax suggested above after allowing 8 per cent. on capital. The point in which this scheme differs from existing taxes on profits is that it is based on a sound principle—namely, that every form of capital has a right to a return before it is taxed for surplus profits. The need of the hour is to try to devise some scheme which will yield as good a return as possible without unduly hampering business. It is claimed that a surplus profit duty on the lines indicated would secure a fair recognition of the right of capital to a return, and so would be less likely than other forms of direct taxation to turn fresh capital into channels other than those of industry.

Engineers' Clubs for London and Birmingham. — Whilst going to press, we learn that a movement towards forming an Engineers' Club in Birmingham has progressed so far that an option has been exercised on premises for the purpose.

The London movement is also developing satisfactorily; we shall be glad to hear from those interested.

BUSINESS NOTES.

Bankruptcy Proceedings.—J. W. Layton, electrician, 5, Nobles Bank, Hendon, Sunderland. The first meeting of the creditors of the above was held on December 17th, at the Official Receiver's Offices, 3, Manor Place, Sunderland. There was not a quorum of creditors present, and no resolutions were passed, the Official Receiver remaining trustee of the estate. The statement of affairs showed gross liabilities of £505, of which £460 were unsecured and expected to rank for dividend. There were fully secured creditors for £44. The assets consisted of furniture estimated at £50, book debts estimated to realise £6, a surplus of £13 from the securities in the hands of the fully secured creditors. The debtor attributed his position to losses on contracts caused by the rise in the price of platinum.

A. E. Channon, H. Stanton and C. G. Channon (A. E. Channon & Co.), electrical engineers, Cheltenham.—Last day for receiving proofs, December 30th. Trustee, Mr. T. Easton (Official Receiver), 26, Baldwin Street, Bristol.

Company Liquidations.—Electrical Engineering Society, Ltd. (late the Electrical and Mechanical Co-operative Trading Society).—Winding up voluntarily. Liquidator, Mr. A. Glass, 5, Cook Street, Liverpool.

Roger Dawson, Ltd.—Mr. A. Niabet, of 3, Lincoln's Inn Fields, W.C. 2, ceased to act as receiver or manager on December 6th, 1920.

Cannon Motor and Electrical Works, Ltd.—Winding up voluntarily. Liquidator, Mr. P. G. Clegg, 10, Cannon Lane, Brighton.

Rotasphere, Ltd.—Particulars of claims must be sent to the liquidator, Mr. E. H. Hawkins, 4, Charterhouse Square, E.C., by January 14th.

Alliance Electrical Co., Ltd.—Meeting of members is called for January 14th, at 32, King Street, Covent Garden, W.C., to hear an account of the winding up from the liquidator, Mr. E. McArthur.

Catalogues and Lists.—Boving & Co., Ltd., 56, Kingsway, W.C. 2.—Leaflet No. 101, a detailed and illustrated description of standard low-lift pumps suitable for direct or belt drive.

The Midland Electric Power Installation Co., Old Mill Street, Wolverhampton.—An illustrated booklet dealing with the objects and accomplishments of the firm. The illustrations show various departments of the works. A calendar is embodied in the booklet.

The Edison Swan Electric Co., Ltd., Ponders End, Middlesex.—A folder, illustrated by photographs, describing the "Lazilite" telephone extension arm. Prices for various styles are given. Also Leaflet No. B B 197, a priced leaflet illustrating the "Ediswan-Acme" portable hand-lamp.

The Wholesale Fittings Co., Ltd., 23-27, Commercial Street, E. 1.—Supplement E 97, a comprehensive illustrated price list (16 pp.) of lighting fittings, including bowl fittings, standards, lanterns, and pendants. Also deals with "Victory," "Hecla," and "Champion" electric fires.

R. A. Evans, Ltd., Prospect Road, Leicester.—A list (12 pp.) of lifts and lift engines. The illustrations are very good, two being in colour.

The Sun Electrical Co., Ltd, 118 and 120, Charing Cross Road, W.C. 2.—Catalogue No. 316, "High-Efficiency Lighting" (28 pp.), illustrating many types of lanterns and reflectors—extensive, intensive, angle, indirect, and semi-indirect—bowl fittings of various reflecting and refracting materials, and gasfilled tungsten lamps. Prices are given very fully.

The Marconi Scientific Instrument Co., Ltd., 21-25, St. Anne's Court, Dean Street, Soho W. 1.—Abridged catalogue of wireless and laboratory apparatus (16 pp.), illustrating and describing variable air condensers, potentiometers, resistances, &c. Also an illustrated list dealing with amplifiers, tuning units, valves, &c. Both lists are fully priced.

Millars' Timber and Trading Co., Ltd., Pinners' Place, E.C. 2.—An illustrated folder describing the "Schramm" portable petrol-driven air compressor.

Trade Announcements.—Venner Time Switches, Ltd., have removed their works and offices to much larger premises at 45, Horseferry Road, Westminster, S.W. 1.

English Electric & Siemens Supplies, Ltd.—The sales department of this company (also of Messrs. Siemens Brothers and Co., Ltd.), formerly of Central House, New Street, Birmingham, has removed to new premises, and in future its address will be English Electric & Siemens Supplies, Ltd., White House, 111, New Street, Birmingham. Telephone, Midland 964; telegrams, Siemens, Birmingham.

Enterprise Manufacturing Co., Ltd., has appointed the Isis Electrical Co., of 57, Albert Road, Aston, Birmingham, its agents for the Birmingham district.

Swedish General Electric, Ltd., has appointed Mr. A. N. Douglas, of 4 Pembroke Terrace, Queen Street, Cardiff, its agent in the South Wales district.

Messrs. Wilson Hartnell & Co., Ltd., 11, New Station Street, Leeds, announce that owing to a fire at their works, on December 17th, difficulty is being experienced in carrying on the business for a few days.

Inquiries.—The name and address of makers of "Carabon" insulating material, of a non-automatic s.p. cut-out for battery charging switchboards, of an electrically perfect cement to withstand 1,000° C., and of composition connectors for electric heating appliances, are asked for.

New Welsh Mines.—The Ebbw Vale Steel, Iron, and Coal Co. has commenced to sink two shafts for a new colliery at Aberbeeg, near Newport, to be worked entirely by electricity generated at the company's works at Ebbw Vale. It is expected that within the next 10 years employment will thus be provided for 2,500 men, and that the output will be about a million tons per annum, the area of coal available being about 1,200 acres. The shafts will be 20 ft. in diameter, and will be sunk to the old coal seam, an estimated depth of 500 yards.—*Daily Telegraph.*

Book Notices.—"The Electrical Power Engineer." Vol. II. No. 5. November, 1920. 24 pp. Price 4d.—This number of the official organ of the E.P.E.A. contains a full account of the Southern Division dinner, and proceedings of the various divisions and sections.

Scientific Paper No. 400 of the U.S. Bureau of Standards, "Ionization and Resonance Potentials of some Non-Metallic Elements." 32 pp. Washington: Government Printing Office. Price 5 cents. The elements treated of are phosphorus, iodine sulphur, nitrogen, oxygen, and hydrogen.

"B.B.C. Mitteilungen." Vol. VII. No. 9. September, 1920. 25 pp. Baden (Switz.): Brown, Boveri & Cie.

"The National Physical Laboratory. Collected Researches." Vol. XIV. 1920. 307 pp. London: H.M. Stationery Office. Price 25s. net. The amount of work in optical research represented by this volume is enormous. Methods of measuring refractive indices, dispersion, &c., in various types of glass and work on telescopic objectives of many descriptions make up the bulk of the volume, adding valuable data to the resources of the science. In production the work is an excellent example of the printer's art.

"L'Eclairage Electrique." By L. Barbillon and P. Bergeon. 160 pages, 87 figs. Paris: A. Michel. 15 fr.

"Science Abstracts." A and B. Vol. XXIII. Part 10. No. 274. October 31st, 1920. London: E. and F. N. Spon, Ltd. Price 2s. 6d. each.

Utrecht Industries Fair.—Holland's Fifth Industries Fair, which is to be held at Utrecht from September 6th to 16th next year, is the first of the series to be made "international." Its representation for the United Kingdom has now been taken over by the Federation of British Industries, in the belief that its success in its more restricted "national" character will be even greater now that it is thrown open to the exhibits of all nations. It is hoped that British goods will bulk largely at the fair next year, and that both members of the Federation and other manufacturers will take advantage of the new opportunities offered. The fair was started in 1917, when the war was still raging, and this and other factors made it necessary to confine exhibits to Dutch products. This restricted beginning, however, made it possible to perfect the organisation of the fair much more easily than has been the case with the majority of similar enterprises, and Dutch thoroughness is visible both in attention to detail and grasp of essentials.—*Financier.*

B.T.H. Operatic Society.—Following upon their success with "Iolanthe," the members of the B.T.H. Amateur Operatic Society produced "Patience" on December 13th, and it ran for the whole of last week at the Hippodrome, Rugby. We have received a souvenir programme showing a splendid "cast" and full chorus. The future arrangements of the Society provide for the production of "The Gondoliers," "The Mikado," and "The Yeoman of the Guard."

E.D.A. Activities.—We are pleased to see that encouragement is being given by the E.D.A. to organisers of local electrical exhibitions. These bring the residents of the districts in which they are held into much closer touch with the possibilities of electrical aid than the larger central exhibitions. In this connection the E.D.A., in a circular letter to managers of electricity undertakings, offers its aid in publicity and other directions, and it is to be hoped that full advantage will be taken of this opportunity of obtaining expert assistance.

Among the new publications of the Association recently received are many of high "attention-drawing" power. A postcard depicting a smiling female face reflected in the polished bottom of an electric iron bears the title: "The Reflection of a Housewife with an Electric Iron." A folder headed: "Just a Turn of the Switch," illustrates a number of domestic appliances, and draws attention to their advantages and simplicity. "A Present Problem Solved" is a leaflet suggesting a way out of the worry which usually attends the selection of suitable presents at this time of the year. The attraction of the electric fire, shown in a leaflet, "Healthy Radiant Heat for the Office, Home, and Factory," seems to be irresistible to a couple of business men who are posed before it. The interior of this pamphlet contrasts heating by raw fuel and electric heat.

The pamphlet E.D.A. 106, giving notes on the statutory provisions and regulations for protection of the meters, terminals, and fuses of public electricity suppliers is of great value to electrical contractors, the essential points being simply and briefly stated.

These and the other publicity matter should prove powerful agents in the electrical education of the public.

Calendars.—Mr. W. M. Harris Burland, 63, Queen Victoria Street, E.C. 4, agent for Messrs. R. A. Evans, Ltd, Leicester, has sent us two calendars of high artistic merit. One, showing some horses enjoying a rest from their labours, is entitled "Sunday Evening." The other, "A Breezy Morning," depicts a man and his dog on some high ground, while grey clouds are flying over a town in the distance.

Messrs. J. H. Woolliscroft & Co, of New Quay, Liverpool, have issued a calendar, with daily slips printed in red, mounted on a stout card base.

Messrs. Mawdsley's, Ltd., Zone Works, Dursley, Glos., have issued to their friends a most acceptable wall calendar. The subject is a study of a lady, holding a bunch of flowers, looking over a wall, with the wording at foot, "Between You and Me." The date-slips are quite unobtrusive.

The Industrial League and Council, of 82, Victoria Street, has sent us a pocket diary which will be of use with regard to Labour organisations.

Hudson's Electrical Engineering Co., Ltd., has produced a wall calendar with bi-monthly slips illustrated by Cecil Alden.

For Sale.—Farnworth Urban District Electricity Department invites offers for one two-flued Lancashire boiler, no fire boxes, 30 ft. × 8 ft. 6 in., 200 lb. pressure. See our advertisement pages to-day.

The Crisis in Electricity Supply.—The strike notices served by the E.P.E.A. on those undertakings which have failed to agree with the award of the National Joint Board have been deferred until December 30th, at the request of the Minister of Labour. It is understood that in the London district, Finchley, Hornsey, Hackney and Ilford are still standing out.

There is to be no strike of electrical engineers in the East Midlands, a settlement having been arranged at a meeting of representatives of municipal and privately-owned electricity undertakings and the Electrical Power Engineers' Association, held at the Guildhall, Nottingham, on December 16th.

The towns affected by the negotiations included Nottingham, Derby, Loughborough, Mansfield, Long Eaton, Kettering, Northampton, and Burton-on-Trent.

After deliberations extending over three hours, the following resolution was agreed to:—

"In view of the fact that the electricity undertakings represented at this conference have agreed to adopt the schedule and conditions, save that where the conditions vary they are equal to or better than the conditions proposed, this conference recommends that these undertakings be classed under Group 'A.' It is further agreed that steps be taken to make the Joint Board fully representative of all electricity undertakings."

Submarine Apparatus for Monte Video.—The Department of Overseas Trade has received an inquiry from a firm of marine and mining engineers in Monte Video, which desires to be placed in touch with manufacturers of the following plant:—Submarine apparatus for submersion to depths of over 150 metres; under-water telephone and electric light apparatus; centrifugal electric pumps to work under water for marine purposes; air pumps for divers; waterproof canvas for diving suits; salvage tugs; deep-water lighters of small tonnage, constructed of either wood or iron and driven by crude petroleum or naphtha engines; and all salvage apparatus in general. The firm desires to receive catalogues and prices, with a view to purchasing in this country; its name and address may be obtained from the D.O.T., at 35, Old Queen Street, S.W. 1.

Electrical Trade in Jugo-Slavia.—By a recent Government decision the following, among other, goods are admitted duty free:—Motors and their parts, transmission lines, transformers, condensers, accumulators, electrodes weighing less than five kilogrammes, cables and other electric conductors, material for electric conduits, accessory material for the chemical industry, and electric rolling stock.

New Italian Company.—A company, which should attract the attention of English manufacturers, has just been formed in Milan, under the style of Società Anonima Importazione Fornitura Industriali, with a capital of 100,000 lire, with the object of facilitating the importation into Italy of material and special articles, not obtainable in Italy, required in the electrical industry. The demand created by the great development of hydro-electric works is more particularly in the minds of the promoters, but railway conversion, telephone and telegraph reforms are not excluded. The new company is really an offshoot and department of the firm of Boneschi, Milan, and has been embodied as a distinct company with a capital of its own, with a view to carrying out its programme more fully.

Local Exhibitions.—A local electrical exhibition is being held in Cardiff at the end of January next.

Mr. Turnbull, borough electrical engineer, is organising an exhibition of electrical goods at Aylesbury from February 14th to 16th, 1921.

Copper and Lead Prices.—Messrs. F. Smith & Co. report, December 21st:—Copper (electrolytic) bars, £87, £7 decrease; ditto sheets, no change; ditto wire rods, £105, £2 decrease; ditto H.C. wire, 1s. 1½d., ½d. decrease; silicium bronze wire, 1s. 10d., 1d. decrease.

Messrs. James & Shakespeare report, December 21st:—Copper bars (best selected), sheets and rods, £134, £5 decrease. English pig lead, no change on last week's prices.

Annual Dinners.—The annual dinner of Messrs. Wilson Hartnell & Co., Ltd., was held on December 11th, at the Hotel Metropole, Leeds, and was followed by an enjoyable smoking concert.

A large number of the officials and employés of Messrs. A. Reyrolle & Co., Ltd., Hebburn-on-Tyne, spent a very enjoyable evening on the occasion of the annual dinner of the company's fire brigade, on Saturday, the 11th inst., at the Station Hotel, Hebburn, Mr. N. Merz presiding.

New French Companies.—Under the style of La Lampe Phillips has been formed at Paris (8, Cité Paradis) a company, with a capital of 2,000,000 fr., for the manufacture of the Phillips lamp.

With a capital of 100,000 fr. has been embodied at Paris (122, Avenue de la République) the Société Anonyme Française "Synergie," for the manufacture and sale in France, her colonies and protectorates, of machines, tools, and instruments of precision.

The Société des Grands Réseaux Electriques—great electric networks company—has been embodied at Paris (8, Rue Lamennais), with a capital of 1,000,000 fr. in 500-fr. shares, of which 168 are allotted to the Société des Grandes Enterprises Méridionales, 168 to M. Theveninel, and 166 to the Société des Constructions Métalliques. Names of officials of the Ponts et Chaussées Department are on the strong board of directors.

Under the title of Auvray et Berger has been formed at Paris (5, Passage St. Pierre Amelot) a company, with 100,000 fr., to carry out electrical undertakings.

With a capital of 700,000 fr. has been constituted the Electrification Industrielle (Lousteau Petit et Cie.). M. Lousteau receiving 3,000 100-fr. shares for his assets. The offices of the company are at 12, Boulevard du Temple, Paris.

At St. André de Cubzac (Gironde) has been formed the Société d'Energie Electrique Cubzaguaise, with a capital of 500,000 fr.

There has been established at Paris (15, Rue César Franck) the Société d'Applications Electro-mécaniques, with a capital of 500,000 fr.

A new company has just been formed in Paris (5, Rue Blanche), with a capital of 12,000,000fr. and the title La Société des Forces Motrices de l'Ariege, to establish a large electricity generating station in the Ariege district.

There has been formed at Ile-et-Vilaine, Rennes (24, Boulevard de la Liberté), the Société d'Enterprises Hydrauliques et d'Utilisation Industrielle des Marées, whose objects are the survey and carrying out of electric generation works, utilising the force of the tides for the purpose. Among the directors is M. Parisot, well known in connection with the Rance River tidal scheme. The company's capital is 500,000 fr.

New Belgian Company.—There has been established at Brussels (5, Rue des Colonies), the Société Anonyme Horlogerie-Contrôle-Electricité, with a capital of 200,000 fr., for the purchase, sale, manufacture, and installation of all kinds of electrical and mechanical apparatus.

The Debt of Honour.—The monthly chart issued by the Labour Ministry showing the progress of reabsorption into civilian life of disabled and fit ex-officers and men gives the position at the beginning of December as follows:—

Disabled Men.—20,251 unemployed (November, 18,881).
Ex-Service Men.—230,798 unemployed (November, 217,359).
Officers.—11,924 unemployed (November, 11,719).
The King's Roll.—22,820 firms in the national scheme (November, 22,418).

To the above unemployment figures substantial additions should be made to cover cases not on the Ministry's registers.

Dr. Macnamara states:—"The position disclosed by the chart is not a very satisfactory one. No one can pretend that, while the facts are as disclosed, the nation's debt of honour to these men has been anything like requited. It is true, so far as the number of ex-Service men registered as unemployed are concerned, that the numbers on the registers at the beginning of December are less than they were in January, February, and March of the present year. But in those months demobilisation was proceeding at an accelerated pace, and every man returning from the Army automatically registered at the Employment Exchanges. The progress made month by month up till September was continuous and steady, the numbers having decreased from 388,138 in January to 130,137 in August. Since then the barometer began to fall, and, I am sorry to say, the downward tendency still continues. Many of the men already settled in industry are being thrown back on the unemployment registers, and this applies not only to the fit ex-Service men, but to the disabled and ex-officers.—*The Times.*

Lead Report.—Messrs. G. Cawson & Co., writing on December 18th, say:—Closing prices yesterday were:—December, £22 10s. to £22 15s.; January, £23 5s. to £23 10s.; February, £23 10s. to £23 15s.; March, £24 to £24 5s. The heavy arrivals pressing on the market seem now to be pretty well cleared, and there is a good inquiry for next year's deliveries. Electrical works continue to take lead in fair quantities. With regard to supplies, there is now likely to be a considerable falling off in arrivals. London at present is the dumping ground of all the surplus lead in the world, and prices here are decidedly lower than in any other country. The outlook now seems rather clearer, and we are inclined to look for a steady improvement.

Electric Dish Washer Wanted.—To meet the scarcity of servants in Italy, the Società Piemontese d'Igiene has decided to award a prize of 1,000 lire to the inventor of a cheap electrical apparatus for the automatic washing of kitchen utensils.

Railway Management.—Proposals as to the future working of the railways have been made by the F.B.I. in response to the schemes outlined in a White Paper (Cmd. 787), dealing with this subject, recently issued by the Ministry of Transport. Referring to the suggested grouping of systems, the Federation thinks that any such combination should be one of management rather than of ownership, and should also be of a voluntary nature. It is recommended that not more than 11 shareholders' directors, and at least four traders' directors should be included in the composition of the suggested group boards of 21 directors. Excess profits, it is stated, should be used to lower charges, instead of going to the National Exchequer, or to a development fund. The appointment of a technical adviser to the Minister of Transport is called for; also a Finance Tribunal to fix fares and rates. It is suggested that this tribunal be composed of three members, and that it take the place of the Railway and Canal Commission. The report also deals with wages, which, it says, should be fixed with due regard to the effect upon the general wage level of the country, and not solely from the point of view of the railways.

Finland's Industrial Production.—The Commercial and Industrial Administration of Finland has published statistics concerning the value of the country's production in 1919. Given in Finnish marks, the figures show that the value of the output of the engineering works was 266,300,000 marks, that of the machine industry 1,000,000 marks, and that of the electrical industry 51,300,000 marks.

Japanese Commercial Depression.—A report on the above subject has just been received by the Department of Overseas Trade from Mr. E. F. Crowe, O.M.G., Commercial Counsellor to His Majesty's Embassy in Tokio. Mr. Crowe states that he has recently paid visits to Kobe and Osaka, where the situation is even more acute than in the north, and after interviews with many leading business men, both Japanese and foreign, he has formed the following impressions:—"The general opinion seems to be that matters will grow worse before the end of the year, and that there is no hope of improvement before Spring. Any improvement which may then be forthcoming will be dependent on conditions in America. The latest trade figures for the period up to the end of August show a total of 1,897,000,000 yen imports, and 1,467,000,000 yen exports. The returns for trade with the United Kingdom for a similar period stand at about 150,000,000 yen imports, and 75,000,000 yen exports. Notwithstanding the heavy adverse balance, the yen to-day is worth nearly 3s., instead of 2s. 0¼d., the par rate of exchange. This fact, coupled with the large and steady imports of gold, which exceed 120,000,000 yen since the commencement of the year, proves that Japan's finances are on a sound basis.

"One of the largest items in the import trade is that of metals. During the war large fortunes were realised by the importers, and the shortage of iron and steel was so great that many new iron works were commenced, and big sums were expended on the purchase of the necessary plant. It is said that to-day not one of the new iron works is paying its way, several have had to close, and the others are carrying on at a heavy loss. There are two factors of special interest connected with the metal trade; one is the heavy importation of galvanised sheets and tin plates by concerns which were inexperienced in the business, and now find themselves burdened with enormous stocks which have depreciated in value. In normal years Japan exports about 40,000 tons of copper, and imports none. For the first half of this year she exported only 3,500 tons, and imported 20,000 tons. There was no domestic demand to justify such figures, and naturally a heavy drop ensued with the result that the copper has had to be re-exported at a serious loss, and the speculators are on the verge of bankruptcy."

The Swedish Electrical Industry.—The Swedish Association of the Electrical Industry (Elektro Industri Forening) has presented a petition to the Government pointing out that the situation of the industry has become more unfavourable during the past six months, and renewing a previous application for the accommodation of the import duties charged according to weight to the depreciation of money so as thereby to restore the Customs protection which was granted to the industry by the rates introduced in 1911. It is stated in this connection that the imports of electrical products in certain branches have assumed such dimensions as to tend to paralyse the native manufacturers, the expired months of the present year having already recorded imports of the value of 11,330,000 kr., as compared with exports of 6,000,000 kr. in the same period. It is submitted that through its trading departments the State possesses the possibility of supporting the national electrical industry, but the State seems to carry on a contrary policy. If through a scarcity of orders the industry is compelled to restrict working, the Association considers that it is a question whether the Government authorities will not have to pay out as unemployed grants a sum greater than the difference in prices resulting from purchases from other countries. In the opinion of the Association the action of the State under the existing extraordinary circumstances should not be considered from a narrow-minded point of view, but should be regarded in connection with its consequences to the general community—the more so as the State's taxation policy has materially contributed towards the diminution in the industry's power of endurance in face of the strains of the present times. As an instance of the dimensions assumed by the imports, it is mentioned that the glow lamp makers now have stocks on hand sufficient for the requirements of the country for one year, and they, therefore, look forward to the future with some concern. The production of electrical measuring apparatus, which has been in course of favourable development, is now confronted with a scarcity of work, as appreciable orders have recently been placed in other countries; while the production of installation materials is declared to have practically ceased in consequence of the large imports. In conclusion, the Association points out that the value of the output of the electrical industry last year amounted to 130,000,000 kr., so that it represents a not immaterial factor in the national economy. On the other hand, Mr. Edstrom, manager of the Allmanna Svenska Elektriska A.B., is reported to have stated that foreign competition has hitherto not caused the company—the largest in Sweden—any serious concern. The inland sales have not diminished, while the company's exports have experienced an increase. He added that the company has managed to meet foreign rivalry for 40 years, and has reason for hoping also to be successful in the future.

Market for Machinery in the Trieste District.—Long before the end of the war nearly all the industries in Trieste and its hinterland had closed down except mines, transportation, and public utilities' service, and factories engaged in the production of military supplies. In the district of Gorizia many industries were destroyed during the numerous battles in that region. During the war very little new machinery was introduced, and much of the existing machinery became antiquated, worn out, or defective. Hence, there is an extensive market for up-to-date machinery in this region. According to the United States Consul at Trieste, the material chiefly in demand includes electric apparatus and appliances, water meters, turbines, tools, cranes, steam and oil engines, equipment for shipbuilding, mining, and textile machinery. The steam and electric railways are also in great need of equipment and supplies. Jugoslavia, German-Austria, Hungary, and other countries of the hinterland are in need of locomotives and rolling stock on account of the great losses and deterioration in consequence of the war.

Among the new projects which will create a considerable demand for machinery is the plan to connect up the hydro-electric plant of the Celina in the Veneto with the Isonzo plant at Monfalcone and the hydroelectric plant of the Recina with the hydroelectric plants of the Celina and the Isonzo. Plants especially in need of new equipment and machinery are textile mills in German-Austria and Jugoslavia; the coal mines of Istria and Dalmatia; the tramways of Trieste, Pola, and Gorizia; and the shipyards of Trieste and Monfalcone.

Competitors to be Met.—The machinery manufacturers of Italy have not as yet placed any considerable quantity of their products in this territory. Italian machinery sold here consists principally of oil-burning engines, lathes, and engines for motor cars. Italian cranes and steam engines do not seem to have made any headway in this market. British-made machinery sold here consists chiefly of winches for ships, boilers, and turbines. Before the war most of the machinery in use in this region was made either in Austria or Germany, owing to the high tariff duties imposed on the imports from other countries. Now Austrian and German manufacturers must compete on equal terms with other countries.

Pending the restoration of normal conditions in the countries formerly constituting the Austro-Hungarian monarchy no extensive improvements or large investments of capital in productive enterprises have been made. For the present such projects are at a standstill, but those interested will no doubt promote them as soon as conditions are more favourable and the required capital is available. In the meantime manufacturers of machinery should organise their export business so that they will be able to compete in this territory. It would be advisable to study conditions on the spot and to form connections with good local technical or engineering firms which have the facilities for exhibiting, handling, and installing machinery. Ample stocks of machines, spare parts, and supplies would thus always be available for the prompt filling of orders and execution of contracts.

A German Steel and Electrical Combination.—As was briefly mentioned in a recent issue, the Siemens and Schuckert group proposes to enter into an agreement with a great coal and steel combination which before the war controlled an annual production of over 15,000,000 tons of coal, the object in view being to reduce the costs of production and enhance the export possibilities in manufactures.

An official communication that has been issued states that the directors of the Siemens & Halske Co. and of the Nuremberg Schuckert Electricity Co., subject to the confirmation of the shareholders at forthcoming meetings, have decided to enter into a community of interests with the Gelsenkirchen Mining & Ironworks Co. The agreement already concluded a short time ago between the latter and the Deutsch-Luxemburg Co. for a period of 80 years through the formation of the Rhine-Elbe Union, aims not only at improving the methods of working, but also at cheapening them. The Siemens-Schuckert group associates itself with this fundamental idea, and is endeavouring to carry it out to its final results in highly developed manufactures. The economic situation of Germany renders it necessary to strengthen the existing individual undertakings and seek out new ways which lead to the highest technical and economic efficiency in the production of manufactures. For this purpose the electrical industry must obtain

influence to the extent that the raw materials and semi-finished products offered to it are of such a quality as not only to cheapen the methods of working, but also to raise the value of the manufactures to a higher level.

The communication proceeds to state that the industry must also render itself free from the oppressing anxiety in the matter of obtaining raw materials, and assure itself a smooth course of working which, by the avoidance of all unnecessary transport, will place it in the position substantially to reduce the time occupied in manufacturing. The new combination ensures the possibility of exporting, in place of raw materials and semi-finished products, finished manufactures in the production of which large amounts are paid in wages. It will be possible materially to curtail the amount of stocks held, avoid roundabout ways of production, and effect a considerable economy in capital. The combination forms a counter-balance against the injurious effects of the fluctuations in the situation of trade for all the parties concerned, and promotes a more uniform degree of employment for the workmen and the staff. It is intended to conclude the agreement on the same principles as the agreement of the Rhine-Elbe Union, and the independence of the electrical firms interested remains untouched, while the adhesion of the Nuremberg Schuckert Co. secures for Bavarian industry the desirable influence in the supply of coal and iron and steel which is now lacking.

It will be seen that the communication is not accompanied by any details. This leads to the assumption that for the moment only a fundamental agreement exists, and that the details of the contemplated association of interests will only be brought forward in time for the general meetings. The firms concerned in the first place are the Siemens & Halske Co. and the Schuckert Co., of Nuremberg. As is known, the former chiefly produces apparatus for weak currents, and has interests in German and foreign works engaged both in the heavy and light electrical engineering branches. On the other hand, the latter is mainly concerned with the manufacture of electric welding apparatus and electrochemical plant, and at the same time has considerable interests in power, tramway, and hydro-electric works.

It is, however, not these particular interests—it is asserted—which are inducing the two companies to enter into the projected community of interests, but the necessities of their subsidiary in the form of the Siemens-Schuckert Works of Berlin, to which both companies transferred their heavy electrical departments quite a number of years ago. The new association will not only place at the disposition of the electrical firms interested supplies of coal and iron and steel, but also to some extent brass and aluminium and freight accommodation through the Stinnes group, which is the author of the Rhine-Elbe Union, and the moving spirit in the present scheme.

It should be added that the Rhine-Elbe Union is based upon the pooling of profits, the Gelsenkirchen Co. and the Deutsch-Luxemburg Co. each having a share capital of 130,000,000 marks. The share capital of the Siemens & Halske Co. is now 126,000,000 marks, and will probably be increased by 4,000,000 marks so as to bring it to the level of that of the other two companies, while that of the Schuckert Co. is 70,000,000 marks, and if the capital remains at this figure the company will not enter the combination on an equality with the other three partners.

LIGHTING AND POWER NOTES.

Barnes.—Loan.—The Lighting Committee recommends application to the Electricity Commissioners for sanction to borrow £10,000, which is the estimated cost of mains and services for the ensuing three years.

Beckenham.—House Lighting.—The Electricity Committee reported at a recent meeting of the Council that the estimated cost of cable extensions and house wiring for the Elmers End housing scheme was £5,700. It was resolved to apply for sanction to borrow this amount.

Bootle.—Electricity Scheme.—The Bootle Corporation has approved of the electricity scheme for the Merseyside and West Lancashire area, but it was pointed out at a recent Council meeting at which this decision was reached, that the consumers would be better served by an extension of their own electricity undertaking as was proposed in 1917. It was stated that the opposition of Birkenhead and Wallasey was not to the scheme, but to the area; Southport had not yet decided whether it wished to be grouped with Liverpool or with Preston; similarly, Warrington halted between Liverpool and Manchester, whilst St. Helens agreed to the scheme and the area. A plea is being made for the extension of the local electricity works and for financial safeguards.

Bridlington.—Proposed Price Increase.—The Electricity Committee has decided to apply for an Order to increase the statutory maximum charge for electricity supplied under the Bridlington Electric Lighting Order (1900) from 8d. to 1s. per unit, or such other amount which will be sufficient, so far as can be estimated, to enable the undertaking to be carried on without loss.

Chester.—Bulk Supply Necessary.—At a recent meeting of the City Council the chairman of the Electricity Committee outlined the scheme for the North Wales and Chester Electricity District under the Electricity (Supply) Act of 1919. At the present time the capacity of the plant, both in Chester and Wrexham, was taxed to its utmost, and there was little likelihood of the needs of the district being adequately catered for for two or three years unless they obtained an independent bulk supply. Negotiations had been in progress for 12 months with the Government with a view to utilising for this purpose H.M. factory at Queen's Ferry, which was capable of developing 5,500 kw., but no decision had been arrived at so far. The Council had received a letter from the War Office saying that the matter was under consideration.

Continental.—Russia.—The generation and distribution of electric power in Russia is under the control of the Soviet Department for Electricity. This Department manages 10 nationalised power plants, 45 nationalised factories for electrical machinery, telephones, and telegraphs, and 19 works not yet nationalised. The aims of the Soviet Government are to build new power plants and to supply electricity to farmers, sawmills, mines, and to all the larger foodstuff producers. A statement issued by the Government regarding the future of the electrical industry in Russia is full of optimism, and goes so far as to say that all the hydro-electric resources of the country will be utilised to bring the country to a state of prosperity unparalleled in its history. The figures showing the power production of the Moscow and Petrograd plants from January to April, 1920, show, however, that practical conditions are very far behind these aims of the Soviet Government. In Moscow only three of the existing five power plants were running in January; the other two were put to work later on, with insignificant results. Only 8,000,000 kw.-hours are produced in Moscow per month. In Petrograd the power production is still less, and was in March at its highest point, with 6,800 000 kw.-hours. In these two cities nine of the ten nationalised power plants are situated. The electricity works in the provinces, such as exist, are still in private hands, but are mostly shut down for want of fuel.—*Power.*

Bulgaria.—A Bill has been introduced into the Bulgarian Legislative Chamber for the utilisation of water power and irrigation works; also a draft Bill relating to syndicates for water undertakings. Surveys have been made for the utilisation of the rivers Topolnica, Kritchin, Luda-Yana, Strema, Eli-Dere, Tchaj, Tundja, Vinkos, and Suttica. They show that 1,000,000 h.p. may be utilised in Bulgaria, of which the railways and various industries could consume 130,000-150,000, the rest being available for agriculture and irrigation and the supply of drinking water by electric pumps to dry districts. The works will be undertaken either by the State or private corporations. A Water Board will be set up at the Ministry of Agriculture.

Austria.—H.M. Consul at Vienna reports that, according to the *Reichpost*, the construction of the Strubklamm power station was recently commenced. The completion of the work is contemplated for December, 1921. The total cost will be 54 million crowns, which will be covered by a loan of the municipality of Salzburg, amounting to 80 million crowns.

Czecho-Slovakia.—The State Council of Electricity Works has drawn up regulations determining the conditions of utilisation of natural sources of power and the type of electric current to be used in the establishment of power stations (production and distribution).—*Economic Review.*

Norway.—The Financial Department of the Norwegian Government recommends the raising of a loan for the account of the State, either in the home or foreign markets, to yield a total of 50,000,000 kronen for the purpose of placing the funds at the disposal of the communal authorities so as to enable them to complete their respective electricity supply works. The local authorities will have to reimburse the State the expenses of the proposed issue, and the interest and redemption charges. It is pointed out by the Department that applications have been received from a number of communes asking for loans for electricity works, the total amounting to 140,000,000 kronen (about £7,000,000). Some of the applications refer to works which are not yet begun, and they consequently do not come within the scope of the assistance which was contemplated by the Government, and from which the Department does not propose to depart.

France.—There has just been set up in the Department of Puy-de-Dôme an Office des Forces Hydrauliques, whose duty, among other things, is the preparation of a hydroelectric map of the department and neighbourhood showing all the existing waterfalls. The important rivers of this Department are the Dordogne, the Bave, and the Allaynon, and on the first-named the Société de l'Energie Industrielle has just been granted a concession to build a dam, which will supply from 2 000 to 6,000 h.p., the installation being estimated to cost 10,000,000 fr. Another concession, on the Upper Dordogne, has just been accorded to the Force et Lumière company. On the Bave, the Omnium Régionale d'Electricité has just secured a concession for a waterfall yielding from 1,200 up to 4,000 h.p., to be utilised to supply various communes, and the Charbonnier and Mégecoste mines.

Sweden.—*Svenska Dagbladet* learns that the Sydsvenska Kraft Aktiebolaget (South Swedish Power Co.) intends to erect a new power station at Skogaby on the River Lagan in the parish of Yaby, which will provide about 12,000 h.p.—*Reuter's Trade Service* (Stockholm).

Doncaster.—Extension of Supply.—The Electricity Committee, having received an application from the Bentley-with-

Arksey Urban Council for a supply of electricity to a housing site at Arksey Lane, has recommended that the borough electrical engineer be authorised to comply, subject to the Bentley Council's undertaking to provide and connect up the necessary low-tension cables to the houses from a transformer sub-station on the site.

Galashiels.—Proposed New Station.—The Town Council will hold a conference to discuss the question of a central electricity supply station for that district of the Borders. Messrs. Buchan & Partners, consulting electrical engineers, Edinburgh, have prepared a scheme.

Harrogate.—Breakdown.—The electricity supply failed on December 13th in the late afternoon, and the town was plunged in darkness. This was the second breakdown within a week. The Corporation's overloaded plant is being extended.

Hull.—Proposed Extensions.—The Electricity Committee is faced with the necessity of extending the undertaking, particularly with regard to railway sidings, coal storage accommodation, and plant. At a special meeting, Major H. Bell, the electrical engineer, was instructed to prepare a scheme for the extension of the electricity works.

Kingstown.—L. & N.W. Railway Improvements.—In connection with the taking up of the Kingstown and Holyhead Royal Mail service, under Government contract, by the London and North-Western Railway Co., considerable improvements are to be made at Carlisle Pier and the railway station in Kingstown, a feature being the introduction of electrically-controlled apparatus for the handling of the mail bags, baskets, &c.

Kirkcaldy.—Sale of Undertaking.—The Town Council's negotiations with the Fife Electric Power Co. for the sale of the municipal electricity undertaking to the company have been temporarily suspended—apparently because the Council is waiting to see what arrangements are to be made in connection with the formation of a Joint Electricity Board in Fife.

Liverpool.—Dock Electrification.—Considerable progress has been made with the electrification of certain parts of the Liverpool docks. The Hornby to Sandon Dock section, the first part of the scheme for general electrification, will be completed shortly. All the main cables are laid, and the Canada sub-station is ready for connection with the Corporation mains. The erection of the Hornby station is completed, and the erection of converters, &c., is well advanced. The wiring of the sheds on the dock quays is now in progress, and about half the work is completed ready for use. The electrification of the Gladstone Dock system has been decided upon, and the necessary contracts have been placed.

London.—St. Marylebone.—In connection with the provision of H.T. equipment and cables to the new premises of Messrs. Selfridge, the Electricity Commissioners have now sanctioned the borrowing of sums of £2,000 for mains and £4,400 for transformers and switchgear. The amount sanctioned represents approximately 80 per cent. of the sum applied for (excluding contingencies), and the Commissioners state they will be prepared to consider the borrowing of any further sum which may be required when the actual cost of the works has been ascertained.

Street Lighting.—On grounds of economy, the City Corporation is being asked to authorise the reduction of the number of lights in the principal City thoroughfares.

Midlands.—Breakdown.—The Midland Electric Corporation for Power Distribution, Ltd., whose generating station is at Ocker Hill, issued a notice, on December 14th, to power consumers, stating that owing to a serious breakdown at the station, involving two of the largest generators, they were compelled to curtail supply. Power, they intimated, would not be available in Tipton, James Bridge, Brierley Hill, Quarry Bank, Lye, Stourbridge, Wednesbury, and other districts on Friday, December 17th, and Wednesday, the 22nd, between 7.45 a.m. and 5 p.m. A covering letter stated that the plant had been fully loaded for some time past, and new plant had been ordered to meet the increased demand. The new plant should have been delivered some months ago, but owing to strikes, it had not been received. A further accident took place at the works on December 15th, curtailing still more the supply of energy to works in parts of the Black Country. Another letter was issued to consumers informing them that if they would agree to use only one-half of their motors, it would be possible for a continuous supply to be given each day during the hours of 7.30 a.m. and 5.30 p.m. It was announced by the company on December 18th that a large majority of consumers having agreed to reduce the motors in use by 50 per cent., the daily supply of electricity would be resumed to that extent on December 20th.

Nottingham.—Report on Extensions Adopted.—The Corporation, at its last meeting, adopted a report of the Electricity Committee, under which it is proposed to expend £1,193,000 in carrying out the first portion of an extended scheme of local electricity supply, according to plans prepared by Mr. J. H. Rider. It was proposed that, in addition to the sum mentioned for the new plant, £30,000 should also be borrowed for the extension of underground mains and outside service connections, it being explained that the annual amount allocated for such work had already been expended, extra-high-tension mains having been laid to several large factories and warehouses.—Alderman A. Ball, Deputy Mayor, asked for an assurance that all the plant would be of British manufacture, as several municipal authorities had recently departed from this principle. Alderman Huntsman promised that the point should be very carefully considered.

Plymouth.—Loan.—The Electricity Committee is applying to the Electricity Commissioners for sanction to borrow £20,800, including the following items:—1,000-kw. converter with foundations, &c., £8,700; D.C. switchgear, £1,020; E.H.T. switchgear, £2,450; H.T. switchgear, £2,400; new switchboard at Prince Rock, £4,000.

Prestcign.—Public Lighting.—The Urban District Council has rejected a motion to rescind the resolution of August 6th, giving permission to the Electric Light Co. to carry electricity services into the town. The proposer of the motion asserted that the company had not offered to supply electricity for public lighting, but a letter from the company stated that it would do so as soon as it was able to give the supply.

Salford.—Proposed Large Station.—A one and a quarter million pounds' scheme for the extension of the Corporation electricity undertaking was approved at a meeting of the Council on December 15th, and authorisation was given to the promotion of a Bill in Parliament to obtain statutory powers to carry out the scheme. The Electricity Committee has purchased land on the banks of the river Irwell, where it is intended to build a large station. The scheme for the extensions has been prepared by the borough electrical engineer, Mr. J. A. Robertson, and has received the general approval of the Electricity Commissioners. The station will take three years to build.

Southport.—Protest Against Price Differences.—At a meeting of the local branch of the Middle Classes Union a resolution was passed calling the attention of the Southport Corporation to the fact that considerable differences exist in the charges for electric lighting between one trade interest and another, and protesting emphatically against such differences. A copy of the resolution has been sent to the town clerk.

Spenborough.—Loan Sanctioned.—At last week's Council meeting it was announced that sanction had been received for the borrowing of £7,200 for electricity development purposes.

Stourbridge.—Electricity District.—On behalf of Stourbridge and Lye an objection has been lodged against a suggestion made by the Worcestershire County Council that these districts should be included in the South-West Midlands Electricity District. It was pointed out that the present frequency of the A.C. supply in the district was 50 cycles, whereas the supply proposed was 25 cycles; this would mean an enormous amount of alteration of plant.

Swansea.—Extensions.—At a meeting of the Electricity Committee the town clerk reported that arrangements between the Gellyceidrim Colliery Co., Ltd., and the New Cwmgorse Colliery Co., Ltd., were almost ready for completion, and that it was necessary to obtain the consent of the Electricity Commissioners to the construction of a main transmission line from the generating station to the Amman Valley. The borough electrical engineer submitted estimates and tenders for the construction of the necessary works, and it was resolved that application be made to the Electricity Commissioners for their consent to the arrangements, and to the construction of a main transmission line from the generating station to the Amman Valley; and for their consent to the borrowing of the sum of £40,000 for the construction of the works.

Todmorden.—Breakdown.—One of the largest generators in the Corporation electricity works broke down on December 16th owing to faulty insulation. It was stated that it would take at least a week to repair the machine. Several mills had to close down, while others could only run on alternate days, as the output of the rest of the plant was not sufficient to meet ordinary requirements.

Turton.—Lighting Contract.—Messrs. Wilson Hartnell and Co., Ltd., Leeds, have received the official order from the Urban District Council to carry out cable extensions and street lighting schemes to the extent of upwards of £20,000.

Walsall.—Loan.—At the meeting of the Town Council, on December 13th, it was decided to borrow £20,400 in respect of the electricity undertaking.

TRAMWAY AND RAILWAY NOTES.

Bradford.—Allocation of Profits.—At a recent City Council meeting, a resolution from the Society of Locomotive Engineers and Firemen objecting to the profits of the tramway undertaking being used for the relief of the rates, was read; they favoured the profits being used for the reduction of fares and extension of the present tramway system. The matter was referred to the Tramways Committee.

Brazil.—Railway Electrification.—According to a cable received by the Department of Overseas Trade from the Commercial Secretary to H.M. Embassy in Rio de Janeiro, Congress has authorised the expenditure of 60,000 contos (at present exchange approximately £2,900,000) on the electrification of the Central of Brazil Railway, which is owned and operated by the Brazilian Government. No details are at present available, but United Kingdom firms requiring further particulars are recommended to get into touch with the Inspectoria Federal das Estradas, Ministerio da Viacao e Obras Publicas, Rio de Janeiro, or with the Commercial Secretary to H.M. Embassy at Rio de Janeiro.

Continental.—Italy.—By the inauguration, on November 9th, of the Turin-Bussoleno section, the entire line from Turin to Modena, begun in 1912, has been completely electrified. It is now possible to travel electrically through the Simplon Tunnel direct from Rome to Paris. International communications will be still further advanced when the sections Turin-Genoa-Spezia, now actively under way, are completed.

Recent progress made in the use of continuous current at high pressure, and the results achieved abroad, induced Italian engineers to study a system hitherto unknown in Italy, and the first electric railway designed and started since the conclusion of the Armistice, as also the first electric railway on the continuous-current system in Italy, is now in active construction, but will not be working before the summer or autumn of 1922. It is the Rome to New Ostia Electric Railway. The length of the railway line is 24·3 km., with a branch line of 4·3 km. Continuous current at 2,400 volts is supplied to the railway. The choice of 2,400 volts was made because considered sufficient to feed the whole network from a single sub-station without any considerable fall of pressure on the lines. The sub-station is situated centrally about 15·8 km. from Rome, and at about the highest point of the track. The energy will be supplied in the form of three-phase alternating current at 30,000 volts and 40 cycles. The rolling stock will consist of trains of six coaches drawn by locomotives, with supplementary trailers and auto-motors for periods of slack traffic and the winter season. The motor cars will be like those on the Torino-Lanzo-Ceres line, of a total power of 920 H.P., with a mean speed of 60 km. per hour on the level. The auto-motors will have a power of 95 H.P., having, with two trailers, a speed of 60 km. per hour on the flat. Both locomotives and auto-motors will be fitted with pantograph current collectors, automatic adjustable brakes, and other security apparatus. The special features of the installation, says *L'Elettrotecnica*, make it an excellent model for the much-debated electrification scheme of the Italian railways.

Sweden.—The special Committee appointed to investigate the question of the electrification of the Swedish railways is expected to conclude its labours about the beginning of February next year, and the actual work will probably begin during the same year.—*Reuter's Trade Service* (Stockholm).

Cork.—Tramcar Destroyed.—During the recent incendiarism in the city, a tramcar which had been abandoned in one of the streets affected was destroyed by fire. The accumulation of *débris* on this route caused a suspension of traffic for a considerable time.

Durham.—Protest Against Transport Scheme.—Under the auspices of the Middle Classes Union, a public meeting was recently held at Durham to protest against excessive expenditure by local public bodies, the Durham County Council in particular. The Council's big passenger transport scheme came in for severe criticism, being strongly condemned as unnecessary and extravagant.

Edinburgh.—Supply Refused to Tramway Co.—The Electricity Committee, after considering an application from the Musselburgh Tramways Co. for a supply of electric power, decided, in view of the present demands of the city, that it could not grant the request at present.

Lancaster.—Breakdown.—Owing to the breakdown of a generator at the Corporation electricity works, it was found necessary to suspend temporarily the tramway services between the hours of 3.30 and 5.30 p.m.

London.—New Metropolitan Trains.—A new train was brought into service on the Metropolitan Railway, on December 16th. In this train—the first of a number actually under construction—the company is dispensing entirely with the end vestibule, and is utilising the space thus saved to give added seating accommodation, and providing in lieu three sets of wide double doors, evenly distributed along the car. Each car contains seats for 50 passengers, arranged transversely on both sides of a spacious aisle. Strap-hanging has been completely abolished, and in its place "steadying rails" are conveniently placed. Another innovation is a glass screen flanking each door, which, in addition to giving passengers immunity from draught, has the effect of breaking the car up into a series of semi-compartments. The heating, ventilation, and smooth running show a marked improvement on previous types, and special features include the dome roof and the softening of lights, obtained by the use of opal reflectors. Delivery of further cars will be made at regular intervals, and from now onwards there will be a gradual approach to the company's objective of increasing the present seating accommodation by 20 per cent., which, based on present traffic, will approximate over 100,000 additional seats daily.—*Daily Telegraph*.

New Bakerloo Rolling Stock.—On December 20th eight new cars were put into service on the "Bakerloo" Underground Railway. It is stated that an additional 4,888 seats per day will thus be provided.

Manchester.—Christmas Stoppage.—Manchester, for the third year in succession, is likely to have no tramcar service on Christmas Day. The employés have refused to work on that day, and even offers of double pay for a five-hour shift have failed to tempt them to alter their decision.

Peru.—Storage-Battery Tramway.—The Peruvian Government has granted a 60-year concession for the construction and operation of a standard-gauge electric tramway, which will run from Lima to La Punta, a distance of seven miles. The cars to be used will be of the storage-battery type. It is stated that the new company will have a capitalisation of about $1,000,000, all of which has been subscribed by Peruvians.—*Electrical Review* Chicago).

Rochdale.—L. & Y. Railway Electrification.—The General Purposes Committee of the Town Council has decided to support the Oldham Corporation in its efforts to induce the Lancashire and Yorkshire Railway Co. to electrify its line from Rochdale through Oldham to Manchester.

Sunderland.—Arrangement with Company.—The Town Council has agreed to an arrangement with the District Tramway Co. for through-running of the company's cars over the Corporation route to the centre of the town. Workmen's fares are to be abolished, despite an appeal on behalf of the workmen for a compromise by increasing workmen's fares 50 per cent.

Walsall.—New Cars.—The Tramways Committee recommends that application be made to the Ministry of Transport for sanction to borrow £22,558, the cost of 10 new tramcars.

Wimbledon and Sutton Railway.—The Minister of Transport has extended the time until July, 1922, of the Metropolitan District Railway Act, 1915, for the construction of the railways and works authorised by the Wimbledon and Sutton Railway Act, 1910.

TELEGRAPH AND TELEPHONE NOTES.

France.—The large Lafayette wireless station at Croix d'Hines, near Bordeaux, which was built by the U.S. Navy during the war, and which was handed over to France some time ago, as already reported in this column, was formally presented to the French Government on December 18th by Admiral Mayruder, on behalf of the American Ambassador. The station has a radius of 7,000 miles, and consists of a central transmitting station and eight receiving towers over 800 ft. high arranged over an area of 100 acres.—*The Times*.

Italy.—New Wireless Station.—The plans are in course of preparation for the erection of a high-power wireless station at Fiume, and the work of erection is expected to be taken in hand very shortly.

Ships' Wireless.—At a recent meeting of the Commission nominated to report on the obligation imposed during the war on certain ships of the Mercantile Marine to carry wireless apparatus, the advisability of extending the regulation to embrace almost all merchant ships was urged. The obligatory use of wireless stations and the carrying of skilled wireless operators, in the numbers prescribed by the International Convention of London, 1912 and 1914, were also advocated.

The Italian Government Decree 243, of February 9th, 1919, is steadily remedying deficiencies in the matter of telephone facilities. The decree gives the right to communes, or sections of communes with populations not under 1,000, to claim installations. The Provinces of Bergamo, Aquila, and Teramo, through their officials, are among the latest applicants, and the plans are now being drafted.

Telephone Rates.—Select Committee's Report.—The Select Committee of the House of Commons that was appointed to consider the revision of telephone rates has completed its report. According to the *Morning Post*, the Committee has adopted in the main the recommendations of the Departmental Committee. The view is accepted that payment for the telephone service should be proportionate to the use made of it, and the Committee thinks this can be best carried out by an annual rent, plus a rate charge for each call. The rentals suggested vary according to the character of the area, but are generally about £7 or £8, and a charge of 1½d. for each call is proposed. No difference is to be made between the telephones in private houses and telephones on business premises. The Committee, in recommending the abolition of the unlimited message, or flat, rate for the hire of telephones, has added, says the *Daily Mail*, a proposal that an instrument to record the number of calls made should be attached to each telephone, so that the subscriber may have an effective check on the number of calls for which he is charged. In answer to a question, the Assistant Postmaster-General informed the House of Commons that, as a preliminary step to the introduction of revised telephone charges, each existing contract would be determined by three months' notice. Each subscriber would receive a full statement of the new rates, and a fresh form of agreement for consideration some weeks at least before his present agreement expired.

Trans-Atlantic Wireless.—Increased Rates.—On account of the increased landline rates in this country and in North America, Marconi's Wireless Telegraph Co., Ltd., will raise its charges for ordinary full-rate trans-Atlantic wireless telegrams by 1d. per word as from January 1st next. Press rates will remain unaltered.

United States.—Communications Conference.—While the Communications Conference has achieved nothing as far as the future disposition of the ex-German cables is concerned, a *modus vivendi*, under which the present handling of the cables will continue until March 15th next, was reached on December 13th, as announced in our last issue. Meanwhile, deliberations will continue, the respective Ambassadors of the participating countries replacing the delegates, who will return and report to their Governments. It was also agreed that as from January 1st, 1921, careful accounting may be kept of profits or losses of the cables affected, so that such should be divided proportionately among the five Powers according to the terms of whatever agreement is finally reached.—*Reuter's Trade Service* (Washington).

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia. — Queensland. — January 26th, 1921 P.M.G.'s Department. Telephone apparatus and parts. Schedule 509. (December 10th.)

Sydney.—January 31st. Municipal Council. H.T. and L.T. cable (specification No. 628). Electric Lighting Department, Town Hall, Sydney.

Belgium.—Antwerp. January 11th. Installation of electric light in the bonded warehouses at Antwerp. Copy of the specification in French can be seen up to December 24th, at the Department of Overseas Trade (Room 48), after which date it will be available for loan to firms in the provinces.

December 27th. The municipal authorities of Schaerbeek, Brussels. For the supply of 122 section-boxes and 230 junction-boxes in connection with the local electricity supply undertaking.

Blackpool.—December 31st. Borough Council. Electrical wiring and fitting of the houses on two sites in connection with the municipal housing scheme; 164 houses on the Layton Estate, 246 houses on the St. John's Estate. (December 17th.)

India.—Meerut. — January 17th, 1921. Government of United Provinces hydro-electrical installation. Generating station equipment, including workshop equipment, H.T. transmission and distribution (overhead equipment, including poles), sub-station equipment, pumping station equipment and piping, &c. Mr. G. McHoey, sanitary engineer to the Government, United Provinces, Allahabad.—*Reuter's Trade Service* (Bombay).

Leyton.—January 11th, 1921. Urban District Council. Electric wiring of 142 houses on the Barclay estate. (December 10th.)

London.—Battersea.—January 5th. Borough Council Electricity Department. Pipework for a 5,000-kw. turbo-alternator. (December 17th.)

H.M. Office of Works. January 6th. Six months' supply of electric wire and cable. (See this issue.)

Manchester.—January 24th. Electricity Committee. Six motor-driven circulating water pumps; three motor-driven boiler feed pumps and one motor-driven pump for weight-tank sump. (See this issue.)

Natal.—Durban.—January 26th. Corporation. Supply of telephone cable, paper sleeves, concrete pipes, and various telephone and miscellaneous accessories and materials.

February 16th. One 1,000-kw. rotary converter with transformers and switchgear. Specifications of the above may be consulted on application to the Department of Overseas Trade, 35, Old Queen Street, E.C.

New Zealand. — Napier. — January 17th. Borough Council. One 500-kw. electric generating set. Copies of the specifications and blue prints may be seen at the Department of Overseas Trade, 35, Old Queen Street, S.W.

Auckland. February 22nd, 1921. City Council. One 3,000-kw. H.T. turbo-alternator; two 5,000-kw. H.T. turbo-alternators; four 1,500-kw. rotary converters; four 500-kw. rotary converters, switchgear and transformers; four water-tube boilers, conveyor, pumps, pipework, H. and L.T. cables. (December 17th.)

Paisley.—December 27th. Town Council. The electric lighting work in connection with the Whitehaugh housing scheme. Master of Works, 13, Gilmour Street.

Portrush. — January 1st, 1921. Urban District Council Electricity Department. Gas plant, engines and dynamos, booster and balancer, switchboard, accumulators, overhead and underground cables. (December 10th.)

Rhodesia. — Salisbury. — January 13th. Municipal Council. Electric generating plant, switchgear, cable and converters. Specification (£3 3s.) from the Council's Consulting Engineer, Royal Chambers, Johannesburg.

South Africa.—Johannesburg.—January 13th, 1921. Rand Water Board. Supply and erection of steam boiler, superheater, stoker, economisers, &c., steam turbo-driven centrifugal pumps, condenser, &c., for the Swart Kopjes pumping station. Copies of the specifications, &c, and forms of tender can be seen on application to the Machinery Section, Department of Overseas Trade, 35, Old Queen Street, S.W.

CLOSED.

Dublin. — Great Northern Railway Company of Ireland. Contract for six months for Schedule No. 15, items 11, 12, 13, lead-covered wire. Items 23 to 26 (inclusive) of overhead line wire and tinned copper combined wire.—The Edison Swan Electric Co., Ltd.

London.—Battersea. — Electricity Undertaking Committee. Two 450-kw. mercury vapour rectifiers for the Nine Elms sub-station, £7,903.—Power Rectifiers, Ltd., recommended.

Hammersmith. Electricity Committee recommended bulk supply to Chiswick Electricity Supply Corporation, Ltd.

375 yd. ·075 sq. in. 2 H.T. cable.

Western Electric Co., Ltd. (recommended)	**£635**
Callender's Cable and Construction Co., Ltd.	654

Stoke Newington. — Electric Lighting Committee recommended additional converting plant :—

500-kw. converter and transformer.

Power Rectifiers, Ltd.	£7,443
Bruce Peebles & Co., Ltd.	8,059
Metropolitan-Vickers Electrical Co., Ltd.	4,039
General Electric Co., Ltd. (recommended)	**4,051**
English Electric Co., Ltd.	5,955

South Africa. — Johannesburg. — Municipal Council. Accepted :—

Three 150-kw. transformers and one set of spare coils, £1,277. Six 150 kw. transformers and two sets of spare coils, £1,485. Six 100-kw. transformers, £1,56[illegible].—Bartle & Co.

1,500 sets of 25-amp., 250-v., cut-outs, £362.—W. T. Henley's (S.A.) Telegraph Works Co., Ltd.

150 sets of 50-amp., 460-v., cut-outs.—British Agencies, Ltd.

50 sets 100-amp., 460-v., cut-outs, £55.—S. Thompson.

Owing to the failure of the Griffin Engineering Co. to fulfil the contract for unarmoured cable at £7,081, the Council has accepted the next lowest tender of £7,671 of the Telegraph Manufacturing Co.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—At Albemarle Street, W. At 3 p.m. Christmas Lectures—"The Haunts of Life"—by Prof. J. Arthur Thomson :—

Thursday, December 30th.—"The School of the Shore."
Saturday, January 1st.—"The Open Sea."
Tuesday, January 4th.—"The Great Deeps."
Thursday, January 6th.—"The Fresh Waters."
Saturday, January 8th.—"The Conquest of the Land."
Tuesday, January 11th.—"The Mastery of the Air."

Junior Institution of Engineers.—Friday, December 31st. At Caxton Hall, Westminster, S.W. At 8 p.m. Lecturette on "Drying Plant," by Mr. E. A. Alliott.

NOTES.

A Happy Christmas to Our Readers.—Granted that difficulties and dangers beset this country on every hand, and that 1921 will open with lowering clouds over our industries and our State—are we down-hearted? A thousand times, No! So far, we have successfully mastered each new trouble, and we shall in like manner triumph over those which yet are to come. A nation which could rise to the heights of determination and devoted service by which it won the great war will never go down before a minor threat. Let us "count our blessings," and look forward to the time when peace shall reign within and without our borders "among men of good will"; and in that mood let us put aside our troubles and secure for ourselves a happy Christmas, by the simple, but effective, method—that of striving to make happy those around us.

Artificial Daylight.—Following upon an article dealing with the "Sheringham" device for producing a light approximating to daylight, Mr. M. Luckiesh, of Nela Park, Cleveland, Ohio, writes to the editor of the *Electrical News*, of Toronto, deprecating the idea. He states that he tried this method about eight years ago, but abandoned it in favour of the straightforward method of modifying the light by selective transmission. Mr. Luckiesh's company has had on the market a so-called artificial "north sky light" colour-matching unit for the last seven years, and millions have been manufactured and installed.

In connection with this subject it is of interest to note that a number of "Sheringham" daylight reflectors were used at the recent Advertising Exhibition, for the purpose of exhibiting in their true colours advertising posters on certain stands.

U.S.A. War Laws.—The American House of Representatives has passed the Volstead resolution by which the war laws are repealed; it does not, however, terminate the state of war which still exists between the U.S.A. and Germany.

Transport of Refrigerated Produce.—For the transport by road of refrigerated produce, especially meat, Mr. H. M. Dunkerley, addressing a meeting of the Cold Storage and Ice Association at the Royal Society of Arts on December 17th, strongly advocated the use of electrically propelled vehicles, especially in view of the present high cost of petrol. Admitting that the accumulator vehicle had very definite limitations, he considered it the most economic and suitable for distribution in towns. It could not travel with the speed of a petrol lorry, it could not operate over a bigger radius than 12 miles, and it could not do more than 35 miles in one day unless it returned to its base for a freshly charged accumulator; but this was only a five minutes' job with properly arranged, self-lifting trolleys to take off the old battery and bring up the new. At the same time, it was very handy in traffic; it was the simplest vehicle to drive; the insurance charges were lower than for any other vehicle of like capacity, and, if intelligently looked after, the battery was good for five years' continuous use when of the lead type and for eight or ten years when of the nickel type.—*Morning Post.*

Educational.—The annual report on the 124th session of the Royal Technical College, Glasgow, has just been published. The first part of the report pays a tribute to those members of the College who gave their lives in the service of the Empire, and an illustration showing one side of the beautiful war memorial erected forms the frontispiece; 287 officers and 328 N.C.O.'s and men who were students or members of the staff made the sacrifice, as far as is known, surely a splendid record. A list of 609 war honours awarded is shown in detail, and three V.C.s head the list. Lists of degrees and diplomas, enrolments, donations to the New Development and other funds, gifts of apparatus and material, &c., are given in full.

Finsbury Technical College, which the City and Guilds of London Institute proposes to close next July through want of funds, is steadily gathering strength. The Defence Committee has already secured more than 6,000 signatures to the petition for reconsideration of the matter. Prominent employers in the engineering and chemical industries are in favour not only of retaining the College, but of its better endowment and equipment. A conference of these gentlemen with well-known men of science was held recently, and their views will be laid before the Institute authorities.

The Councils of the Institutions of Mechanical and Electrical Engineers are also considering the subject, and it is likely that a public statement of the claims of the College will shortly be issued.—*Morning Post.*

The Long-suffering Lampholder.—A month or two ago we protested in a "leaderette," bearing the above heading against the increasing practice of employing lampholders to supply power to a multiplicity of domestic appliances. In the U.S.A., in spite of the Society for Electrical Development and "conduleta," "outleta" and other means of easing the lampholder's burden, little by little the load is increasing. The last (but by no means the least) of these "straws" should prove effective in breaking many a lampholder's "back." This device, described in the *Electrical News*, of Toronto, is being placed on the market by an American firm. It is quite a new idea, but this feature is hardly sufficient to secure its redemption; it is a pendant heater designed "especially for chilly rooms," constructed with heavy mica insulation and a nickel case. Its weight and size are not given, but it has a 660-watt loading, which indicates a weight of a pound or two. Thus in addition to the electrical load, which is quite severe enough, there is also the weight of the heater to be borne. It is users of this sort of apparatus who condemn the lampholder (and incidentally the suppliers) as worthless if it breaks down under a load which it was not made to bear. This example will serve to awaken dealers in electrical goods to the necessity for urging upon customers the proper use of the lampholder, instead of remaining indifferent so long as the goods are sold.

Service Note.—A wireless telegraphy course for officers of the Royal Corps of Signals will assemble at the Signal Training Centre, Maresfield, on February 7th, and terminate on April 4th. The course is intended for captains and subalterns who have not attended a short wireless telegraphy course or the wireless telegraphy portion of the Royal Corps of Signal Officers' qualifying course. Applications for vacancies should be forwarded by Commands to the War Office as early as possible.—*Morning Post.*

Static Electricity in Belts.—A correspondent of *Power* reports a case of excessive static electricity occurring in a textile factory. The machine concerned was a 15-H.P. motor fixed to a platform suspended from a wooden ceiling. The frame of the motor was not earthed, the only electrical connection being that of the leads. It was observed that flashing between the stator and rotor took place at intervals of from four to ten minutes, and on dry days was very pronounced. The motor was tested for ordinary faults, but nothing was found out of order. Finally, the flashing affected the stator insulation, and the motor was burned out. A spare motor was fitted immediately, but still there was the same amount of flashing; but when at last the frame of the machine was earthed, the trouble ceased. The writer then proceeded to devise a means of collecting and disposing of the "static" from the belt. This was effected by installing a comb consisting of fine springs, which rested lightly on the belt and collected the accumulated charge and conveyed it through an earth wire to the ground. This device is now generally installed in the plant mentioned by the writer, and is a very effective substitute for the usual humidifying plant.

Relation or Coincidence?—Mr. Carl Hering, writing to *Science*, announces that he has discovered that if the present connecting link between chemical and electrical quantities, the electrochemical equivalent of silver 0·001118 00 gramme per coulomb, were only about ·3 of 1 per cent. higher, the following curious relation would be true for all the elements:—Grammes $\times g = 10 \times$ coulombs $\times$ atomic weight/g in which g is the acceleration due to gravity, 980·597. The faraday (the number of coulombs per gramme ion) would then be equal to $g^2/10 = 96{,}157$, now generally taken as 96,500. It was thought that perhaps the elimination of all terrestrial factors such as atmospheric pressure, temperature, &c., from the value of the electrochemical constant might raise its value by this small amount of ·3 of 1 per cent., but reliable authorities do not consider this probable. Mr. Hering says: "Unless this very slight discrepancy can be adjusted, it would seem that this curious relation is a mere accidental coincidence of numbers," but he thinks it not unreasonable to believe that new and unexpected relations may be found to exist between mechanical, electrical, and chemical constants.

Fatality.—On December 17th, John Chapman, an employé at the Ardenrigg Colliery, near Airdrie, received a fatal electric shock from a coal-cutting machine. While disconnecting the machine from its circuit, he came into contact with a "live" part.

Parliamentary.—In the House of Lords on Tuesday, December 14th, the Women, Young Persons, and Children's (Employment) Bill was read a third time and passed.

Appointments Vacant.—Electrical inspector (£5+), for the City of York Electricity and Tramway Department; plumber-jointer, for the Salford Corporation Electricity Department; meter fixer tester (94s.), for the Bacup Corporation Electricity Department; shift engineer, for the Falkirk Burgh Electricity Works; overhead linesman (90s.), for the Rawtenstall Corporation Tramways. See our advertisement pages to-day.

Correction.—With regard to his contribution to the I.E.E. London discussion on Mr. Woodhouse's paper, Major A. M. Taylor informs us that an error crept into his statement relating to the anticipated eddy-current losses due to the rotating field at 50 periods (see p. 776 of our December 17th issue). He now withdraws his remarks, having indicated the correct results of the tests at the Birmingham discussion. It may also be explained that the tests referred to were not carried out by himself, but at his suggestion, and he was permitted to mention the results achieved.

Centralising British Research.—The scheme to centralise the country's resources in chemical knowledge and research and to apply these to its needs, which has been slowly developing for about two years, will shortly be set in motion, when an appeal for financial support, already drawn up and approved and at present in the hands of Lord Moulton, until lately Director-General of Explosive Supplies, will be circulated among all the chemical firms in the country and to private individuals who recognise the importance of chemistry to the building up of the industries of the Empire. The sum required is £500,000, and it is proposed to devote it to the building and equipment of a Central House to accommodate the principal chemical organisations in the country, of which the chief are the Society of Chemical Industry, the Institute of Chemistry, and the Chemical Society, and to produce and distribute literature. It is proposed that the Central House shall be in London.—*The Times.*

Civil Aviation.—The third report on the progress of civil aviation covering the six-monthly period from April 1st to September 30th, 1920, which was issued as a White Paper on December 10th, signed by Sir F. H. Sykes, controller-general of civil aviation, shows that our air organisation has been improved to meet the steady increase in commercial air traffic. The total number of machine miles, 689,600, is a large increase on the figure for the previous six months. The aggregate machine mileage since May, 1919, is well over a million miles. Similarly the number of passengers carried has increased to 32,345; goods have increased from 25¾ to 86¼ tons, while the number of departures and arrivals to and from the Continent has risen from 734 to 2,445, the value of imports from £131,615 to £376,606, and of exports from £63,743 to £168,300. The number of letters carried since the inauguration of the mail service shows a steady increase, especially on the London-Amsterdam service, and an efficiency of 76 per cent., 94 per cent., and 84 per cent. each has been obtained on the London-Paris, London-Brussels, and London-Amsterdam services respectively. The experimental lighthouse at Croydon has proved of value; two more are to be installed, one at Lympne and one midway between London and Folkestone. The civil aerodromes at Castle Bromwich, Manchester, and Renfrew will be similarly equipped.

The wireless direction-finding apparatus installed at Croydon has proved its value, and the equipment of aircraft with wireless telephone apparatus is extending. Electric landing lights for indicating the direction for landing are being installed at the Croydon aerodrome, and trials are being made at the same aerodrome to test the value of powerful searchlights as a means of helping pilots to locate the aerodrome. The installation of ground stations for wireless telephony and telegraphy has been continued. Investigations have been carried out to secure the illumination of landing grounds, as well as into the question of obtaining electrical instruments for indicating accurately to the pilot his position in relation to the aerodrome and his height above the ground.

An A.C. Mercury-Vapour Lamp.—A new form of high-voltage alternating-current mercury lamp developed by Henri Georges was described recently in the *Revue Générale de l'Electricité*. In ordinary circumstances it is only possible to run such lamps on an alternating supply by the use of special electrodes. M. Georges, however, overcomes the difficulty by introducing neon gas into the tube, which is of quartz.

The lamp is connected to a 110/3,000-volt transformer and when first switched on exhibits the characteristic spectrum of luminescent neon. This, however, is quickly replaced by the mercury spectrum as the mercury volatilises, and in seven minutes the lamp attains a steady state. There is then a drop of 125 volts per inch (50 volts per cm.) of tube, and an internal temperature of 1,300°F. (700° C.) is attained. The present lamp takes 1 ampere at 2,250 volts, but it is hoped to construct lamps taking up to 10 KW. and furnishing the most powerful source of ultra-violet light known.—*Electrical World.*

INSTITUTION NOTES.

Institution of Electrical Engineers.—At the last meeting of the Institution, the President, Mr. Ll. B. Atkinson, announced that Mr. André Blondel had been elected an hon. member, and that at the second informal meeting, which is to be held towards the end of January, certain suggestions and propositions connected with the activities of the Institution, which were raised at the special meeting when the subscription increases were considered, are to be discussed; the President has promised to be present.

The Council's proposals for the increase of subscription rates which were passed after full discussion by a large majority at a special general meeting held on the 2nd inst. (see pp. 738 and 764 of our December 10th issue) were confirmed at a second meeting held on December 17th. In view of the announcement that the resolution already passed at the first meeting would be further opposed, a second set of proxy papers was issued to members, but no serious opposition was raised at the confirmatory meeting. The cost of issuing the two sets of proxy papers was stated to have been £120.

Benevolent Fund.—The Council of the Institution has received from Mr. E. M. Hughman, of Bombay, an offer of a donation of £250 to the Benevolent Fund of the Institution, on condition that 19 similar donations are received before March 31st, 1921. The Committee of Management of the Fund earnestly hopes that the 19 donations specified will be forthcoming, as the Fund will thereby be benefited to the extent of £5,000. All communications should be addressed to the Secretary of the Institution at 1, Albemarle Street, London, W. 1.

Royal Society.—At the ordinary meeting held on December 9th, the following papers were read:—"Double Refraction and Crystalline Structure of Silica Glass," by Lord Rayleigh, F.R.S.; "The Effect of Asymmetry on Wave-Length Determinations," by Prof. J. W. Nicholson, F.R.S., and Prof. T. R. Merton, M.A.; "The Effect of Concentration on the Spectra of Luminous Gases," by Prof. T. R. Merton, M.A.; "The Measurement of Low Magnetic Susceptibility by an Instrument of New Type," communicated by Prof. J. W. Nicholson, F.R.S.; "The Internal Energy of Inflammable Mixtures of Coal-Gas and Air after Explosion," communicated by Sir Dugald Clerk, F.R.S.; and "Multenions and Differential Invariants," communicated by Mr. W. B. Hardy, Sec. R.S.

Institution of Post Office Electrical Engineers.—Mr. E. H. Shaughnessy lectured to the Institution on the 13th inst. on "The Developments of Wireless Telegraphy," features of the lecture being experiments with the Duddell singing arc, and a singing three-electrode oscillating valve. The lecturer mentioned that outside Great Britain, which had moved rather slowly in the matter, the development of the arc had been very great, and its utilisation considerable. Unless they in this country progressed more rapidly, they might be too late to avail themselves of the opportunities which presented themselves.

Glasgow and District Radio Club.—A meeting of the club was held on December 15th. The chairman announced that a meeting would be held on January 5th, 1921, when he (Mr. Dewar) would give a short address on "Wireless Telegraph Procedure," giving examples of messages using Morse code records on a gramophone.

Illuminating Engineering Society.—Mr. J. Herbert Parsons, C.B.E., F.R.C.S., M.B., D.Sc., has been elected president of the society in succession to Mr. A. P. Trotter. Mr. Parsons was the first Chairman of Council of the society, and has taken a leading part in the sections of its work dealing with the influence of light on vision. He is a member of various departmental and other Committees concerned with lighting and its effect upon eyesight.

The Physical Society of London and the Optical Society.—The Societies' annual exhibition, which is to be held on January 5th and 6th, 1921, at the Imperial College of Science, South Kensington, will be open in both the afternoon (from 3 to 6 p.m.) and the evening (from 7 to 10 p.m.). Sir W. H. Bragg, K.B.E., F.R.S., will give a discourse on "Sounds in Nature," at 4 p.m. on January 5th. Emeritus Prof. Archibald Barr, D.Sc., LL.D., will give a discourse on the "Optophone—an instrument which enables the totally blind to read ordinary print," at 8 p.m. on January 5th, and 4 p.m. on January 6th. After the discourse, a demonstration will be given by a totally blind person. At 8 p.m. on January 6th, Prof. C. R. Darling will give a discourse on "Some Unusual Surface Tension Phenomena." All the lectures will be illustrated by experiments. About 50 firms will be exhibiting, and a number of experimental demonstrations have been arranged. Invitations have been sent to the Institutions of Electrical and Mechanical Engineers, the Chemical Society, the Faraday Society, and the Wireless Society of London, and the Röntgen Society. Members of the Societies mentioned desiring to attend the Exhibition should apply to the Secretary of their Society. Others interested should apply direct to Mr. F. E. Smith, F.R.S., Hon. Secretary of the Physical Society, National Physical Laboratory, Teddington, S.W.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Stoke Newington Borough Council Electricity Committee has had under consideration the salary of the borough electrical engineer (Mr. Hann), whose present remuneration under the formula adopted by the Council on July 15th, 1919, amounted to £517 per annum; the Committee recommends that Mr. Hann's salary be increased by the substitution of £500 for £350 in such formula, to take effect as from April 1st last.

In connection with the proposed extensions, the Committee recommends that the borough electrical engineer supervise the work and that he receive as remuneration 2½ per cent. on the cost of the works carried out under his supervision.

The Finance Committee of the Perth Town Council has recommended that the salary of Mr. J. Lambert, Corporation electrical engineer, be increased by £50.

Lieut.-Col. A. F. H. S. Simpson, C.M.G., R.E. (retired), late Director of Wireless, Indian Government, has been appointed to a seat on the Boards of Marconi's Wireless Telegraph Co., Ltd., and the Marconi International Marine Communication Co., Ltd. He has also been appointed a joint general manager of both companies in addition to the present joint general managers—Mr. H. W. Allen, F.C.I.S., and Mr. W. W. Bradfield, C.B.E.

At a complimentary dinner given on the 14th inst., students of the Engineering Department of the University College of South Wales and Monmouthshire presented Prof. F. Bacon with a handsome solid silver rose bowl, as a token of affection and esteem on the occasion of his departure for Swansea. Speeches eulogising the work done by the Professor during the seven years he has occupied the Chair of Engineering at Cardiff, were made by Mr. J. Dyer Lewis, President of the South Wales Institute of Engineers; Mr. David E. Roberts, President of the Cardiff Students' Association, and Mr. Arthur Ellis, last year's chairman of the Western Section of the Institution of Electrical Engineers.

At Preston last week Mr. J. Connor, consulting mechanical engineer to Messrs. Dick, Kerr & Co., was presented with a silver tea and coffee service, hot water bottle and stand, and silver tray, in recognition of his services for 19 years as works manager. Mr. J. Taylor presided, supported by Mr. W. Rutherford, managing director; Mr. R. Livingstone, manager of the Preston Works; Mr. H. B. Player, commercial superintendent; Mr. A. D. Salisbury, general foreman, &c. Mr. Rutherford, in making the presentation, mentioned that Mr. Connor was now transferring his services to the English Electric Co.

Mr. A. Forster, tramway works manager at Stockton-on-Tees, who has been appointed general manager of the Stockton and Thornaby-on-Tees section of the route under the two Corporations, has been presented by the employés with a silver rose bowl, with a pair of vases for Mrs. Forster.

Mr. J. Gardner, formerly with Messrs. Evershed & Vignoles, London, and Sir W. G. Armstrong, Whitworth & Co., Elswick, has been appointed assistant electrical engineer in the installation department of the Sunderland Forge and Engineering Co., Ltd.

Obituary.—Dr. A. Muirhead.—Dr. Alexander Muirhead, whose death was recorded in our last issue, was born on May 26th, 1848, being the second son of John Muirhead, of East Lothian. On the removal of his father to London, he was educated at University College School, where, in spite of the handicap of deafness, he carried off many prizes. Proceeding to University College, he studied under Prof. De Morgan, and afterwards became a pupil of Dr. Matthiessen and worked in his laboratory at St. Bartholomew's Hospital, also assisting Latimer Clark in work on electrical standards. In 1869 he took his D.Sc. degree of London University, choosing electricity in preference to chemistry. Prof. Carey Foster was one of the examiners, and afterwards became a close friend. In 1870 he was made a fellow of the Chemical Society. In 1874 he carried out, in conjunction with the late Mr. Herbert Taylor, experiments to solve the problem of duplexing long submarine cables; and in 1875 he and Mr. Taylor took out a joint patent for an artificial line. During the next few years he successfully established duplex working on many long cables, using the Marseilles-Bona in 1875 and the Marseilles-Malta *via* Bona cables in 1876 for trial purposes. The cable from Ballinskelligs Bay, Ireland, to Torbay, Nova Scotia, belonging to the Direct United States Cable Co., was the first ocean cable to which the system of duplex working was applied. This was done with complete success by Dr. Muirhead and Mr. Taylor in 1878. The working speed on this cable was about 100 letters per minute each way—nearly twice the speed of sim-

plex working. The receiver was the mirror galvanometer. After the death of his father in 1885, he took up consulting work. In 1893 he married Mary Elizabeth, daughter of Mr. William Blomfield, of Upper Norwood, and settled at Shortlands, Kent. About 1896 he became associated with Sir Oliver Lodge, and was jointly responsible for the Lodge-Muirhead system of wireless telegraphy. In 1904 he was made a Fellow of the Royal Society. In later years Dr. Muirhead took an active part in solving the problems in connection with transmission, retransmission, and reception on submarine cables, and a large number of patents dealing with this subject stand in his name; he filed over 40 patents in all, either alone or jointly, all dealing with electrical subjects.

MR. C. F. PARKINSON.—The death occurred, on December 15th, of Mr. Charles F. Parkinson, of Morecambe, at the age of 56 years. He was the first electrical engineer to the Morecambe Corporation, from 1898 to 1901, and was then appointed in a like capacity at Paisley, where he served till 1918, resigning on account of failing health.

MR. W. ARBOUR.—The death occurred at Newcastle-on-Tyne, last week, following an operation, of Mr. William Arbour, chief electrician at Easington Colliery (County Durham).

NEW COMPANIES REGISTERED.

United Lamp-Black Works, Ltd. (171,969).—Private company. Registered December 11th. Capital, £150,000 in £1 shares (75,000 "A" ordinary and 75,000 "B" ordinary). Objects: To carry on the business of manufacturers and sellers of and dealers in oil lamp black and other kindred products and by-products of oil; to acquire, erect, and establish factories and works for the manufacture and production of such black and products; and to acquire, on the terms of two agreements (1) with the General Electric Co., Ltd., and (2) with the Columbian Carbon Co., the Binney & Smith Co., and the L. Martin Co., the leases of the existing factories or works, goodwills of businesses, and other assets referred to therein. The subscribers are: T. Settle, 67, Queen Victoria Street, E.C.4, electrical engineer (1 "A" share); G. W. Holding, 6-7, Stonecutter Street, E.C.4, London manager to Binney & Smith Co., New Jersey (1 "B" share). The first directors are to be nominees of and persons interested in the General Electric Co., Ltd., or the Columbian Carbon Co., and the L. Martin Co. (who are the vendors and promoters). The first directors are: M. Soloman, Beaconstone, Burkes Road, Beaconsfield (managing director, Pirelli General Cable Works, Ltd., and director of Park Hall Pottery Co., Ltd.); T. Settle, 30, Gloucester Square, W.2 (director of Radiator Tubes, Ltd., and The Direct Copper Production Syndicate, Ltd.); G. W. Holding, 57, Goring Road, Bowes Park, N.11 (London manager of Binney & Smith Co., New Jersey); G. C. Lewis, New Dorp, Staten Island, New York (secretary of L. Martin Co., New Jersey). The two first named represent holders of "A" ordinary and the two last named holders of "B" ordinary shares. Solicitors: Wild, Collins & Crosse, Kennan's House, Crown Court, Cheapside, E.C. Registered office: 67, Queen Victoria Street, E.C.4.

Dawson Electrical Installations, Ltd. (171,999).—Private company. Registered December 14th. Capital, £3,000 in £1 shares. To take over the business of an electrical engineer and contractor carried on by Joseph Dawson at 7, Henshaw Street, Oldham. The permanent directors are: J. Dawson, 91, Egerton Street, Oldham; J. Jackson, 173, Chadderton Road, Oldham. Secretary: J. Jackson. Registered office: 7a, Henshaw Street, Oldham.

Oliver Pell Control, Ltd. (171,946).—Registered December 10th. Capital, £100,000 in £1 shares (25,000 8 per cent. participating preference and 75,000 ordinary). To acquire certain assets of Oliver Pell Electric and Manufacturing Co., Ltd., and the Varley Magnet Co., Ltd., and to carry on the business of electrical, constructional, consulting, telegraph, telephone and mechanical engineers, founders, smiths, machinists, &c. Minimum cash subscription, 7 shares. The first directors are: C. Oliver (chairman), 3, Shepherd's Bush Green, Chislehurst, Kent; W. M. D. Pell, Viggory Mead, Horsell, Woking; C. H. Barclay, The Chummery, Abbotsbrook, Bourne End; H. Denton, 60, Venner Road, Sydenham; B. Varley, The Laurels, Littleover, near Derby. Qualification, £500. Secretary: W. M. D. Pell. Registered office: Cambridge Place, Burrage Road, Woolwich, S.E.

Dalton, Downes & Co., Ltd. (171,937).—Private company. Registered December 10th. £5,000 in 200 preference shares of £10 each and 3,000 ordinary shares of £1 each. To take over the business carried on at 37a, Fountain Street, Manchester, by Amedee A. H. Papillon as "Dalton, Downes & Co.," and to carry on the business of manufacturers, exporters and importers of and wholesale and retail dealers in electrical and general vacuum cleaners, electrical apparatus, lamps and accessories, &c. The permanent directors are: Amedee A. H. Papillon, 20, Bournville Avenue, Heaton Norris; P. Trotman, 145, Washway Road, Brooklands, Cheshire; R. Hall, 138, Ford's Lane, Bramhall, Cheshire. The two first named are joint managing directors. Secretary: R. Hall. Registered office: 37a, Fountain Street, Manchester.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Baily Grundy & Barrett, Ltd.—Mortgage debenture dated December 7th, 1920, to secure all moneys due or to become due from company to Lloyd's Bank, charged on the company's undertaking and property, present and future, including uncalled capital, subject to existing first mortgage debentures.

Ricardo & Co., Engineers, Ltd.—Particulars of £11,000 debentures, authorised December 1st, 1920; whole amount issued; charged on company's property, present and future, including uncalled capital, subject as to certain properties in Kingston-on-Sea and Lancing to existing mortgages.

Runbaken Magneto Co., Ltd.—Particulars of £10,000 debentures, authorised November 27th, 1920, whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

White, Jacoby & Co., Ltd. (52,494).—Capital, £7,500 in £1 shares. Return dated October 1st, 1920. 5,734 shares taken up, £3,497 paid, £2,357 considered as paid. Mortgages and charges: £1,330.

Kalgoorlie Electric Power & Lighting Corporation, Ltd. (91,219).—Capital, £225,000 in 175,000 preference shares of £1 and 100,000 ordinary of 1s. Return dated July 8th, 1920. 150,000 preference and 100,000 ordinary taken up, £3 10s. paid up on 7 ordinary, £199,996 10s. considered as paid on the remainder. Mortgages and charges: £15,000.

Delta Electrical and General Engineering Co., Ltd.—Particulars of £1,000 debentures, authorised November 10th, 1920; whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

Hobart Manufacturing Co., Ltd.—Mortgage dated December 7th, 1920, to secure all moneys due or to become due from company to Lloyd's Bank, Ltd., not exceeding £7,000, charged on Etna Works, Albert Road, Hendon. Holders: Lloyd's Bank, Ltd., Holborn Circus, E.C.

United Electric Tramways Co., Caracas, Ltd. (89,642).—Capital, £200,000 in £1 shares. Return dated November 16th, 1920; 170,000 shares taken up and £7 paid; £169,993 considered as paid. Mortgages and charges, £148,600.

Railway Finance and Construction Co., Ltd. (72,015).—Capital, £100,000 in £1 shares. Return dated November 10th, 1920; 92,292 shares taken up and £1 per share called up on 657 and 4s. per share on 29,595; £6,576 paid; £85,716 considered as paid, being £1 per share on 62,040 and 16s. per share on 29,595. Mortgages and charges, nil.

Pacific and European Telegraph Co., Ltd. (36,683).—Capital, £100,000 in £10 shares. Return dated November 10th, 1920. All shares taken up; £4 per share called up and £40,000 paid. Mortgages and charges, £66,800.

CITY NOTES.

Eastern Extension, Australasia and China Telegraph Co., Ltd.

The ordinary general meeting of the Eastern Extension Australasia and China Telegraph Co., Ltd., was held on December 14th, at Electra House, E.C.. Sir John Denison-Pender, chairman, in moving the adoption of the report and accounts, said it was hoped to hold the next meeting at a much earlier date. The enforced delay this year did not prevent the payment at the usual time of the final dividend for 1919, the total distribution being 10 per cent., free of income tax, against 8 per cent. for 1918. Compared with the pre-war year, 1913, the revenue of the past year showed an increase of over 300 per cent., but there had been a considerable addition to the working and other expenses. The principal items of increased expenditure were £109,000 in payments to the staff and other expenses connected with the war, £33,000 attending the maintenance of cables, and £115,000 for war taxation in the Netherlands Indies. The last of these items covered six years—1914 to 1919 inclusive—but in connection with this taxation there was £70,000 of relief from excess profits duty in England and £13,000 for income tax at 6s., making the net payment for Netherlands Indian war tax only £31,000. They proposed to transfer £350,000 to general reserve fund, to make a further provision of £20,000 on account of investment fluctuations, making up the depreciation shown at the end of 1919 within a few thousand pounds, and to carry forward £232,000. The retention of this large sum was due to the uncertainty regarding their taxation liability and the large expenditure required in the near future for developing and improving the company's service in the Far East. The additional cable they had arranged to lay between Madras and Singapore was now in manufacture, and was expected to be laid and opened for traffic early next year. The Great Northern Telegraph Co.'s through route to the Far East materially assisted in carrying the China and Japan traffic up to 1914, when it became interrupted and it was not yet restored. Consequently the company's cables were still carrying this traffic in addition to the large increase in other directions, and additional capacity was now much needed. When the Great Northern route was again working they would be relieved of some of the traffic, but in any case the new cable would benefit the telegraphing public. They had therefore no hesitation in incurring the expenditure for the additional cable between Madras and Singapore. The resolution was unanimously adopted; the usual formal business was transacted, and a vote of thanks to the chairman and directors concluded the proceedings.—*Financial Times.*

Western Telegraph Co., Ltd.

The 87th ordinary general meeting of the Western Telegraph Co., Ltd., was held on December 15th at Electra House, E.C. Sir John Denison-Pender, the chairman, in the course of his address, said that the revenue from all sources had increased by a little over £719,000 and this represented a greater volume of traffic with all the States of South America which were served by the company's system of telegraphic cables. A new cable from North Brazil to the Island of Barbados was laid in September last. A short time before, an expedition had started to lay the connecting cable owned by the Western Union Cable Co., from Barbados to Florida, there to join up with the vast landline system of the latter company in the United States. At almost the last moment, however, the American Government had refused to permit the Western Union Co. to land its cable on American soil, the objection being that the Western Union intended working in conjunction with the Western Telegraph Co., a British company holding exclusive rights from the Government of Brazil for submarine cable communication. A regrettable feature of this unfortunate incident was the active opposition of the British Minister at Washington, who went even further than the United States Government, and issued instructions to the commander of the British ship chartered by the Western Union Co. to lay this cable, not to proceed with the work. However, these instructions were not sup-

ported by the Foreign Office, and the cable was laid, with the end buoyed outside the United States territorial waters, at a position agreed upon with the United States Government. It was hoped that communication would shortly be made, but it might not be by the route originally contemplated. At the last general meeting the continued interruption of the original cable between St. Vincent, Cape Verde Islands, and Pernambuco was referred to; there were two cables connecting these points—a large portion, amounting to nearly 1,000 miles, was last month very successfully renewed, and the cable was again in good working order. In the near future additional cables were to be laid on the Brazilian coast between Pernambuco and Maraham, Pernambuco and Maceio, Victoria and Rio de Janeiro, and Rio de Janeiro and Santos. It was intended also to afford additional facilities to Santa Catharina and Rio Grande do Sul. An order had been placed for the necessary cable to renew the older section between Lisbon and Madeira; the existing cable had been laid some years, and would have been renewed before had not the war intervened. This programme, with cable for stock, would entail a further expenditure of close on £1,000,000. The report and accounts were unanimously adopted, the retiring directors and the auditors were re-elected, and the proceedings concluded with a vote of thanks to the chairman, directors, and staff.—*Financial Times.*

Eastern Telegraph Co., Ltd.

The 89th ordinary general meeting of the Eastern Telegraph Co., Ltd., was held on December 15th at Electra House, Finsbury Pavement, E.C. Sir John Denison-Pender, the chairman, in the course of his speech, said that the gross revenue had reached a figure considerably in excess of any previous year in the history of the company, and was no less than £1,438,000 more than the pre-war year 1913; the gross revenue shown in the accounts exceeded that of last year by £694,000, the total of the year under review having amounted to £4,059,000. This large income had not been earned without a very considerable increase in the working expenses, which were approximately £653 000 more than for the year 1918. Abnormal conditions still prevailed, and expenses had not yet become so stabilised as they were before the war. The bulk of the increase was due to extra payments made to the staff, partly in the form of permanent augmentations of the scales of pay and partly in the shape of temporary payments to meet to some extent the present abnormal conditions of life, but the earnings had enabled the firm to deal generously with its staff. As foreshadowed at the last meeting, a heavy programme of cable laying and renewals was contemplated. During the current year about £1,200,000 had been expended on additional cables from Malta to Alexandria and from Aden to Bombay, part of which would be charged to capital expenditure, as the new capital was specially provided for this purpose; but when the whole of the present programme was carried out a considerable sum would be charged against the general reserve fund according to the usual policy. Securities in which the reserve funds were invested showed a further heavy depreciation, in common with other concerns holding gilt-edged securities, and it had been considered advisable to allocate a further sum of £200,000 from the general reserve fund to the special fund set aside as a provision for this depreciation, which now amounted to £840,000. During the war regular customers had been subjected to many restrictions in consequence of which their commercial service had been hampered, and their telegrams had been, and were still, suffering serious delay. Every effort had been made to re-establish such a service for commercial correspondence as was generally acknowledged to be second to none in speed, secrecy ,and freedom from errors in transmission. A great improvement had already taken place, and when the whole of the additional cables ordered by the company and the Eastern Extension Co. were laid and working it was fully anticipated that the public service would be even better than it was before the war. No better proof could be found of the wisdom of continuing the policy of maintaining a substantial reserve fund than from the example given, whereby large expenditure for new cable, &c., had been provided for without increasing the capital to any serious extent. Every effort was being made to overcome the shortage of staff, so as to relieve present employés. The school had been transferred to Hampstead, where the company had been able to more than double the accommodation for the training of young men in the particular requirements of the service. Two hundred probationers could be accommodated and trained at a time, and as they qualified and passed out to stations, others were engaged to keep the figure constantly up to that number. A pension fund for the staff was established some years ago, to which the company and the staff contributed annually an equal percentage on the salaries. In order to assist the staff the company had relieved them of this burden, and now contributed the whole amount—the annual cost appearing under the heading "staff pension fund" in the revenue account, being £35.552, or over £12,000 more than last year. By the desire of a large number of the staff an associated companies' widows' pension fund was also in process of formation. It would be supported by annual contributions by the staff themselves. The boards had decided to assist those members of the staff who elected to join the scheme by making an initial payment of £38.000 to the fund, the company's proportion being £20,000. With a view to furthering the welfare of the staff the principal associated companies had decided to install a clubhouse and recreation ground.. A freehold property with grounds of about ten acres attached, on the bank of the Thames at Twickenham, was secured some time ago and converted into a suitable clubhouse. Over 16 acres of freehold land had been laid out as a sports ground. The capital sum to inaugurate the clubhouse and recreation ground, about £52,000, had been contributed by the three principal companies, the Eastern Telegraph Co. having agreed to find one-half the cost. The chairman proposed the re-election of the retiring directors, Mr. J. C. Denison-Pender, M.P., and the Rt. Hon. F. Huth Jackson, which was seconded by Lord Pirrie and unanimously agreed to. The auditors, Messrs. Deloitte, Plender, Griffiths & Co., were reappointed, and a vote of thanks to the chairman, directors, and staff concluded the proceedings.—*Financial Times.*
Financial Times.

Increases in German Capital.

The shareholders in *Brown, Boveri and Co., of Mannheim*, have sanctioned an augmentation in the share capital of 35,000,000 marks to 75,000,000 marks by the issue of 30,000,000 marks in 6 per cent. preference shares with single voting powers, and 5,000,000 marks of 6 per cent. registered preference shares each having 15 votes. The latter shares have been taken over by a banking and metallurgical group, and an embargo has been fixed on transfers to the end of 1930.

The Elektrizitats A.G. vorm. Schuckert & Co., of Nuremberg, proposes to make an issue of preference shares in connection with the projected community of interests with the Deutsch-Luxemburg Mining & Ironworks Co., the Gelsenkirchen Colliery Co., and the Siemens & Halske Co. At present the ordinary share capital of the Nuremberg company is 70,000,000 marks, and the issue of 6 per cent. preference shares is also to amount to 70,000,000 marks, the shares carrying simple votes and being of the cumulative type. So long, however, as preference shares remain in the possession of the community participation in the profits will be suspended.

The directors of the *Siemens & Halske Co.* have decided to raise the share capital by 134,000,000 marks to 260,000,000 marks for the purpose of carrying into effect the contemplated community of interests under the title of the Siemens-Rhine-Elbe-Schuckert Union. The new issue is divided into 130,000,000 marks of preference shares and 4,000,000 marks of ordinary shares, the latter bringing the amount of the ordinary capital up to 130,000.000 marks, or the equivalent of the ordinary share capital of the Deutsch-Luxemburg Co., which forms one of the community. As in the case of the preference issue of the Schuckert Co., the preference shares in the Siemens & Halske Co. will be exchanged between the members of the community; they are of the 6 per cent. type, and will not share in the profit distribution so long as they remain in the hands of the community.

The French Cable Co.—The report for 1919 of the Compagnie des Cables Telegraphiques states that the receipts increased from 13,154,000 fr. in 1918 to 17,716,000 fr. last year. The year benefited from the restoration of two cables on the one hand, and on the other, from the placing in service on March 1st, 1919, of the former German cable between Emden, Fayal, and New York, which was now between Brest, Fayal, and New York. Among the securities in portfolio the report mentions 9,725 shares in the Compagnie Générale de Télégraphie sans Fil, and 5,000 shares in the Compagnie de Télégraphie sans Fil of no specified value. The payment to be made to the State for the use of the former German cable was entered at 453,000 fr., but as the State methods of calculation tended to be higher the sum of 440,000 fr. had been set aside out of the credit balance of 6,597,000 fr. for 1919, with the object of harmonising with the Ministerial accounts of December 9th, 1920. It has been decided to pay a dividend at the rate of 28.63 fr. per ordinary share, 37.65 fr. on series 1 shares, and 4.32 fr. on series 2 shares.

Waygood-Otis, Ltd.—The directors announce that the results of the trading for the year ended September 30th are quite satisfactory, but owing to general financial stringency they deem it undesirable to distribute an interim dividend on the ordinary shares.—*Financier.*

Manx Electric Railway Co., Ltd.—For the year ended September 30th, 1920, the gross receipts totalled £89,780, and gross expenditure £48,870, leaving £40,910, after deducting £8,910 the debit balance brought forward, interest on debenture stock £9,000, interest paid on second mortgage debentures from October 1st, 1915, to March 30th, 1920, £5,072 accrued to September 30th, 1920, £1,216, first mortgage debenture stock £1,000, a balance of £15,712 remains. Preference share dividend for two years ended September, 1915, £35, is recommended, carrying forward £1,300.—*Financier.*

British Vacuum Cleaner Co., Ltd.—Report for the year to September 30th 1920, shows net profit, after writing off depreciation of plant, &c., £1,140, and loss on realisation of war stock investment £578, of £1,066, plus £777 brought forward, £1,250 has been placed to reserve, and £562 carried forward.

Crompton & Co., Ltd.—Interim dividend at the rate of 7 per cent. on the preference shares for the six months ended September 30th, 1920.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Temporary Regulation 4 (3):—

Radio Corporation of America.—Preferred stock, 5,000,000 shares of $5 each, American and foreign certificates; and Common stock, 5,000,000 shares without nominal or par value, American and foreign certificates.

The Eastern Telegraph Co., Ltd.—Dividend at the rate of 3½ per cent. per annum, less income tax, on the preference stock for the quarter ending December 31st, 1920; and the third quarterly interim dividend of 2½ per cent. on the ordinary stock free of income tax.

Marconi's Wireless Telegraph Co., Ltd.—The directors announce a dividend of 7 per cent., less tax, on the 7 per cent. cumulative participating preference shares, and an interim dividend of 5 per cent., less tax, on the ordinary shares.

Manila Electric Railroad & Lighting Corporation.—Dividend of 1½ per cent. for the quarter ending December 31st, 1920, on the common stock.

The Eastern Extension, Australasia & China Telegraph Co., Ltd.—Interim dividend for the three months ended September 30th, 1920, of 5s. per share, free of income tax.

International Light & Power Co.—Dividend of 1½ per cent., less British tax, on the preference shares for the quarter ending December 31st.

Marconi International Marine Communication Co., Ltd.—Interim dividend of 5 per cent., equal to 1s. per share, less income tax.

New Issue.—*Bolckow, Vaughan & Co.*—The recent issue of £1,000,000 first mortgage debentures has been heavily oversubscribed.

Shawinigan Water & Power Co.—Dividend of 1¾ per cent. on common stock for the quarter ending December 31st.

Kaministiquia Power Co. Stock.—Dividend of $13½ per $100 share.

STOCKS AND SHARES.

MONDAY EVENING.

STOCK EXCHANGE conditions go from bad to worse. Each day that brings nearer the end of the year also brings with it further liquidation. The failure of Farrow's Bank led to acute flatness in War Stock and other gilt-edged issues. People with money—Christmas is a time of charitable assumption—are not spending it in stocks and shares, and every seller seems to be accompanied by two or more others. The only rise recorded in our lists this week is one of 1¼ points in Anglo-Argentine Tramways 5 per cent. debenture stock. Attention was directed to its cheapness in this column last week.

The West of England has already taken practical steps in the direction of establishing an Electricity Authority on the lines recommended by the Commissioners. The suggested arrangements are worth studying by those who are interested in the subject, but there are no public companies concerned whose shares the London Stock Exchange deals in. The London Companies' issues are heavy, without showing quotable alterations. To sell in any amount would prove a matter of considerable difficulty.

Marconis slumped from 2⅛ to 1 15/16 on the declaration of an interim dividend of 5 per cent. as against 10 per cent. a year ago. The market hope is that this reduction does not necessarily imply the previous year's dividend of 25 per cent. being cut in half. Apologists maintain that the final dividend may even be 20 per cent., but rosy-hued glasses are required to foresee such a result. The bulls of Marconis are disappointed, and their pressure to sell, in the absence of buyers, made the whole Marconi market weak and flat.

It was an unfortunate coincidence that at this very time dealings should begin in the common and preferred shares of the Radio Corporation. The last bargain recorded in American Marconis was at 30s. 9d. last March, and to-day the two Radios, given in exchange for one American Marconi, are worth about 13s. 9d., being 7s. 6d. for the preferred and 6s. 3d. for the common. In due course, a further certificate will be given for what are called the assets, and "another few shillings" is the rather contemptuous valuation set upon these in the Stock Exchange. Holders of American Marconis may justly feel resentful at the way in which their long-tried patience has been rewarded. But it must be admitted that a worse time could hardly have been chosen for the re-introduction of the shares to an active market. To sell them now would certainly appear to be throwing the shares away.

All the pother that has arisen in connection with the American Cable controversy is having no effect upon stocks and shares in the telegraph department. Anglo-Americans are unchanged. Globes and Westerns are ex dividend at 14½. The recent meetings of the Eastern group of companies produced illuminating speeches. According to the schedule of its investments, lately published, the Eastern Telegraph holds large quantities of War Loan, Funding Stock, Victory bonds, and other such descriptions upon which the depreciation this month has been extensive. But the companies are all in a very strong financial position.

Edisons are easier at 14s. 6d. Babcock & Wilcox, nominally 2½ middle, can be bought at this price, or perhaps a little lower. Siemens new shares, 12s. paid, stand at 9s. 3d., equal to 2s. 9d. discount. English Electric new notes are 4½ discount. India-Rubbers remain at 20s., on the passing of the final dividend. Other industrials are heavy. The rubber share market has approached near to demoralisation, on the price of the produce falling below 1s. per lb. A sharp slump in Vickers, followed by a drop in Armstrongs, aroused uneasiness with regard to the armament shares.

Underground incomes are down 3 to 6½, and both classes of shares are lower than they appear to be from the official Stock Exchange quotations. Foreign tractions come under the same harrow of depression. Brazil Tractions shed 2½ points, in spite of earnest counsel to buy the shares from a Montreal house. Only Anglo-Argentine 5 per cent. debenture stock is better, as already mentioned. British Columbia stocks have gone back a little. It is no cheerful Christmas message to write, and a Stock Exchange scribe is bound to feel ashamed at recording such conditions as might be best summed up in "Least said, soonest (we hope) mended."

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1918.	Dividend 1919.	Price Dec. 21, 1920.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	8	12	6	—	£10 0 0
Charing Cross Ordinary	4	7	3⅝	—	10 7 4
do. do. do. 4½ Pref.	4½	4½	2⅝	—	6 8 8
Chelsea	5	4	2½	—	6 8 0
City of London	6	10	1¼	—	8 17 10
do. 6 per cent. Pref.	6	6	17/6	—	6 17 2
County of London	7	8	7⅛	—	10 13 4
do. do. 6 per cent. Pref.	6	6	5	—	7 10 0
Kensington Ordinary	6	7	3⅝	—	9 0 6
London Electric	Nil	2½	1	—	10 0 0
do. do. 6 per cent. Pref.	6	6	2½	—	10 18 2
Metropolitan	5	6	2⅝	—	11 8 8
do. 4½ per cent. Pref.	4½	4½	2½	—	8 0 0
St. James' and Pall Mall	10	12	6½	—	9 12 0
South London	5	6	2⅝	—	9 12 0
South Metropolitan Pref.	7	7	14/3	—	8 13 8
Westminster Ordinary	8	10	4½	—	10 10 6
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	76½	—	7 16 18
do. Def.	23/6	1½	16½	—	9 10 6
Chile Telephone	6	6	5⅝	—	*10 9 1
Cuba Sub. Ord.	7	7	7	—	*10 0 0
Eastern Extension	8	10	15	—	*6 13 4
Eastern Tel. Ord.	8	10	15½	—	*6 11 4
Globe Tel. and T. Ord.	8	10	14½ xd	—	*6 15 7
do. do. Pref.	6	6	8¾ xd	—	7 1 9
Great Northern Tel.	22	22	20½	—	10 14 8
Indo-European	18	10	80	—	8 6 8
Marconi	25	25	1⅞	— 1/16	13 17 9
Oriental Telephone Ord.	10	13	2¾	— ¼	*4 16 4
United R. Plate Tel.	8	8	6⅞	— ⅛	*6 16 4
West India and Panama	1/8	Nil	¼	—	Nil
Western Telegraph	8	10	14½ xd	—	*6 15 7
HOME RAILS.					
Central London Ord. Assented	4	4	43½	—	9 4 8
Mesropolitan	1	1½	20	—	6 5 0
do. District	Nil	Nil	15½	—	Nil
Underground Electric Ordinary	Nil	Nil	9	—¼	Nil
do. do. "A"	Nil	Nil	8/-	—	Nil
do. do. Income	5	4	61½	—3	—
FOREIGN TRAMS, &c.					
Anglo-Arg. Trams, First Pref.	Nil	5½	8	—	9 8 4
do. do. 2nd Pref.	Nil	Nil	2½	—	Nil
do. do. 5 % Deb.	5	5	54½	+1½	9 6 6
Brazil Tractions	Nil	Nil	87½	—2½	Nil
British Columbia Elec. Ry. Pfce.	5	5	58	—	8 12 4
do. do. Preferred	2½	5	55½	—	*6 6 2
do. do. Deferred	Nil	8	22½	—1	*6 10 10
do. do. Deb.	4½	4½	66½	—	7 10 5
Mexico Trams 5 per cent. Bonds	Nil	Nil	40	—	Nil
do. 6 per cent. Bonds	Nil	Nil	51½	—	Nil
Mexican Light Common	Nil	Nil	16	—	Nil
do. Pref.	Nil	Nil	25½	—	Nil
do. 1st Bonds	Nil	Nil	16½	—	Nil
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	2½	—	*7 1 2
British Aluminium Ord.	10	10	18/-	—	11 10 2
British Insulated Ord.	12½	15	1⅝	—	9 4 8
Callenders	25	15	1⅜	—	10 18 2
,, 6½ Pref.	6½	6½	18/9	—	6 18 8
Castner-Kellner	20	17	8	—	5 18 4
Crompton Ord.	10	10	16/6	—	12 2 6
Edison-Swan	10	10	14/6	—6d.	18 15 10
do. do. 5 per cent. Deb.	5	5	72	—	6 19 0
Electric Construction	10	10	16/6	—	11 8 6
Gen. Elec. Pref.	6½	6½	18/-	—	7 4 5
do. Ord.	10	10	1½	—	*8 0 0
Henley	25	15	1⅝	—	5 4 8
do. 4½ Pref.	4½	4½	3½	—	7 4 0
India-Rubber	10	10	1	—	*8 8 0
Met.-Vickers Pref.	—	8	1½	—	9 9 4
Siemens Ord.	10	10	1/3	—	*9 8 2
Telegraph Con.	20	20	21	—	*8 14 3

* Dividends paid free of Income Tax.

PULVERISED COAL AND COLLOIDAL FUEL.

By "IMPERIAL."

It must very often happen that brilliant ideas are born in the minds of those who completely lack the gift of self-expression, so that epoch-making fundamental principles are lost, and the world's advancement is retarded. Furthermore, many who should be classed with the great men of the era must perish as mute, inglorious units. Others there are who can conceive a great principle, can appreciate fully at least its true value, and can put it into execution—as a principle. They lack attention to detail, and while their own enthusiasm carries them on, and enables them to see visions of a new world created by their efforts, their lack of practical success does not give them the power to carry their fellowmen with them. Such are usually called dreamers or charlatans, according to the charity of their critics; they may even be contemptuously referred to as scientists. Yet a third class there is which, even after mountainous labour, is incapable of bringing forth anything greater than a mouse, yet its members can assimilate, more or less superficially, the ideas of others, and make a great braying noise about themselves.

It is often the unfortunate fate of a good principle to fall on such thorny ground. In the one case it is lost, in the others it is damned.

The principle of the burning of pulverised coal is old and obvious. The inventor of the poker was probably its first progenitor, although presumably his forbears may have used a stone or the heel of a boot for the same purpose. Since the combustion of coal consists of the combination of oxygen from the air with carbon, it is necessarily a surface action; therefore, rapid and efficient combustion will be most easily obtained when the ratio of surface to volume is greatest. As Mr. Leonard Harvey quotes in his well-known "Report on Pulverised Coal Systems in America," a cube of coal with a one inch face has a surface of 6 sq. in. If this is divided into cubes of one-hundredth of an inch face, the total surface area is 600 sq. in., and provided that this surface is all exposed to the air, combustion will be very rapid and very complete. The thorough admixture of coal with air necessitates a special design of furnace, more of the nature of a gas-combustion chamber than of the old coal furnace. Under the forcing influence of the stress of war, this system was widely adopted in America, and its good points were greatly emphasised; with quite insufficient experience, and by dint of a persevering blindness to bad features, the system was hailed as a great step forward, and quite impossible hopes were raised in our breasts. Some of these were easily pricked, and in the consequent deflation there seems to be some fear that the system will be as undeservedly condemned as it has previously been praised.

Mr. Harvey saw a large number of installations of pulverised coal plant at work, and was told of their results, perhaps in the usual forceful American style. One would say, moreover, that Mr. Harvey went to America with a belief in, and consequently a bias towards, pulverised coal; further, he returned as the European representative of one of the foremost systems. While he is scrupulously fair in his comparison of the different systems with one another, and certainly does not exalt the Fuller system beyond its competitors, it is open to doubt whether he regards the efficiency of pulverised coal as critically and dispassionately as would, say, a mechanical stoker expert. The arguments and facts in favour of the use of pulverised coal deserve much closer and more critical examination and exposition than have been given them. A more accurate statement of the case would at the same time be more convincing.

For instance, on page 12 of the report, for No. 1 plant, the charges for interest and taxes are shown as £5 12s. 0.5d. per month, which works out at 0.6 per cent. per annum of the capital charge for such an installation, as shown on page 10. Elsewhere 6.0 per cent. is assumed, and apparently a correction should be made, increasing the cost by 1s. 1½d. per ton. On page 13, Table III shows the cost of electrical energy to be 11d. per ton of fuel, whereas with the previous plant it is 4s. 1½d. per ton. For No. 3 plant, on page 13, no cost of energy is included at all. Moreover, in Table III, the cost of electrical energy is shown to average 11d. per ton, and the cost of repairs to electrical plant to average 8d. This is surely an extravagant figure, which is the more amazing since the cost of repairs to mechanical gear, where wear is expected and provided for, is less than 8d. per ton.

Then again, the opinions of users quoted at the end of the report are not exact in their statements, nor is it clear to what plant each paragraph refers—in fact, there is a general atmosphere of haziness. Regarded as a critical examination, one finds it biased; considered as propaganda, one is forced to say that a scientific system cannot be established in the public favour by a course of windy verbiage more suited to the advertisement of Beecham's pills or Bovril. Furthermore, in the spring of 1919, there was a meeting of the Iron and Steel Institute at which Mr. Harvey read a most important paper, without substantially plagiarising his report, which had just been published. Consequently, to obtain the full benefit of Mr. Harvey's publications, one has to read two papers, each some 60 pages in length, and each dealing more or less completely with the subject; what is in one is not in the other, and the consequent amount of cross-referencing is enormous. We believe that a new edition of the report is under consideration; may we suggest that a totally new work should be published, incorporating the matter of both the above-mentioned pamphlets, and that it should be most carefully revised with regard to facts and figures? We do not ask for an absence of bias, but merely for an exact, easily substantiated statement of results obtained.

It must be said that Mr. Harvey's description of the plant and the various methods of preparation for use of pulverised coal is excellent. The importance, and the various methods, of drying are fully dealt with, as well as the methods of grinding, and the relative advantages of air-separation and screening to separate the powdered coal from the coarser particles. If the subject matter from the report and the Iron and Steel Institute paper were incorporated in one volume, there would be an exposition of engineering practice which, while it would be superseded in time, would be of everlasting historical interest, and a constant source of reference.

But what shall be said of colloidal fuel? On November 16th Mr. Lindon Bates and his assistant, Mr. Haylett O'Neill, who claim to be the godfathers of colloidal fuel, occupied an hour and a half of the time of the Institute of Petroleum Technologists in reading two papers which, according to a distinguished speaker in the discussion, contained nothing that could not have been told to an audience of average intelligence in two minutes. We are not endorsing this statement; it certainly took this speaker fully ten minutes to demonstrate how little had been said. However, there was certainly no detail given about the method of preparation, no statement of results achieved, and the greater part of the paper was taken up with a demonstration of the method of determining the calorific value of a composite, given that of the components. Besides this there are wide visions of world-redemption resulting from the economies of labour and shipping, and from the increased safety from fire consequent upon the universal adoption of colloidal fuel.

One speaker in the discussion asked (and from the lack of information in the paper was justified in asking) what improvement was to be expected from the admixture of the finest combustible in the world, namely, oil, with an inferior combustible—coal. Unfortunately, although Mr. Bates and Mr. O'Neill gave some theoretical figures showing that the calorific value of the composite was greater than that of either of the constituents, the practical advantages were not specifically urged, the main points being higher B.TH.U. per cubic foot, and greater safety from fire, since the colloid was heavier than water. Perhaps the word "colloid" should not be used, for one great point of dissension is whether the composite fuel is a colloidal solution or a mechanical mixture.

All of which is most unfortunate for us. We do not, as fuel consumers, care twopence whether it is a colloid—if we know what that is. We mainly want to know what has been done, what can be done, and whether the practical difficulties outweigh the theoretical advantages.

We already know, as Mr. Bates remarked during a momentary break into a viscous flow of commonplace, that "the fuel problem continues to be the fundamental national and international problem of the world," and we are only too well acquainted with the "labour and industrial difficulties which still sorely beset the world."

Mr. Bates came to England with a reputation as an expert on colloidal fuel. His paper has been discussed by petroleum technologists from one point of view. It would be most interesting if he would tell one of the engineering societies something of the subject of which he is a master, and give engineers in England an opportunity of gaining some information on a most important development.

THE LIGHTING OF MACHINE SHOPS.

By FRANK J. MOFFETT, B.A., M.I.E.E.

In a modern machine shop there is frequently difficulty with the lighting system.

When the machines are first fixed, the lighting system being designed for the lay-out gives satisfaction, but as soon as alterations are made in the positions of machines, it is necessary to make use of all kinds of expedients to enable the men operating the machines to obtain sufficient light on their work.

With the usual method of enclosing the wires in screwed steel conduit it is a somewhat costly and difficult matter to make alterations or extensions, and when these become necessary it is very common for works electricians to abandon the conduit system and use temporary connections of flexible cord slung up without regard to appearance, and connected to the nearest lampholder.

After some experience of this kind in a large engineering works, it occurred to me that it should not be impossible to devise a lighting system which would be sufficiently flexible to provide for any altered lay-out of the machine tools in the shop, and it may be of interest to describe the system briefly.

It was decided to effect the lighting of each machine tool by means of a jointed fitting which was bolted to the machine, and which should form part of it. If a machine is shifted, the lighting fitting is moved with it, and it is only necessary to connect it up to the wiring.

The fitting selected is provided with a 10-watt lamp in a vitreous enamelled reflector of the focusing type, and the fitting is capable of sufficient latitude of movement to enable a beam of light to be directed on to any part of the machine where it is required. The lampholder used is fitted with a key switch.

The wiring of the shops is carried out in the usual way with V.I.R. cable in steel conduit, but in place of ceiling roses, multiple-way connection points are provided. Each of these points consists of three lampholders mounted on the cover of an ordinary oblong inspection box, so that three pairs of leads can be connected to the system at each point.

The connection is effected by means of flexible cord, which may be either of the workshop or cab-tire-sheathed pattern. Each end of the length of flexible terminates in an adapter, one of which is inserted in a lampholder forming the terminal of the machine fitting.

When a machine shop is wired a sufficient number of these multiple-way boxes are fixed at intervals in the roof to allow of the connection of the fittings on as many machines as the floor of the shop is capable of accommodating.

The flexible lead is supported by means of insulating eyes fixed in the ceiling, and is arranged to drop vertically over the base of the fitting.

When a rearrangement of the machines in the shop is required, and the machines are moved, it is only necessary to run the flexible cord to the nearest multiple-way box, and fix a few insulating eyes.

The adapter was adopted as the readiest method of coupling the flexible from the machine to the wiring system. It has the advantage over a two-pin plug that it will not pull out of its socket, and the current taken by the machine lamps is so small that there is no risk of trouble from overheating.

The pressure at the terminals of the lamps was fixed at 25 volts, this pressure being obtained by the use of double-circuit transformers reducing the voltage of the supply, which is alternating. The low pressure was decided on to avoid any danger of shock, and to secure the advantage of a lamp with a robust filament. Lamps of the railway type are used, and these withstand well the vibration on the machines, which in some cases is excessive.

One pole of the secondary circuit of the transformer is earthed, so that there is no possibility of the pressure above earth exceeding 25 volts.

There are two indirect advantages obtained by the use of 25-volt lamps: First, it is found that the stealing of lamps does not take place, as lamps of such low voltage cannot be so readily used or disposed of as 100-200-volt lamps; and secondly, as only 10-watt, 25-volt lamps are used for individual lighting, lamps of higher C.P. cannot be substituted.

For the lighting of gangways and open spaces, a separate system of general lighting is installed, this consisting of 60- or 100-watt, 110-volt lamps, which are connected to circuits entirely distinct from those supplying current to the machine lights.

As would be expected, this system of lighting lends itself to a considerable economy in electrical energy. Instead of a 30- or 40-watt lamp, a 10-watt lamp only is required, and owing to the ease with which a powerful beam of light can be thrown on the point requiring illumination, the lighting effect with the small lamps is as good as with larger lamps which are used in fittings incapable of the same amount of adjustment.

From the point of view of the eyesight of the workpeople there is also an advantage, the lamp being entirely enclosed in the reflector does not dazzle with its direct rays, the only light that reaches the eyes of the operator being that reflected from the machine.

The World's Industrial Development.—The British Engineers' Association, in its monthly *Bulletin*, states that reports from the overseas Dominions and foreign countries indicate the determination of those countries to develop their own manufacturing industries, and to treat their own natural resources, at any rate, to an extent that will provide for their local needs. Though the establishment of those local industries and the imposition of tariffs for their protection in early days may increase competition with British exporters, it should be borne in mind that the tendency to self-development is opening up a considerable new market for British manufacturing engineers.

The propaganda work carried on by the British Engineers' Association brings many inquiries for machinery and plant from all parts of the world to its offices, and, to a certain extent, these may be regarded as an index to the world's industrial development. Many of the inquiries are from people abroad who are anxious to develop local industries or to start new ones, but do not quite know who to get to help them.

Obviously manufacturers would be well advised to keep in touch with organisations such as the B.E.A., whose object is to put them in communication with these new markets.

WIRELESS TELEGRAPHY.

By Dr. W. H. ECCLES.

In his inaugural address, as chairman of the Section, to the Wireless Section of the Institution of Electrical Engineers, Dr. W. H. Eccles reviewed the circumstances under which the Section was formed and its work, and recorded the development during the war period of the practice and theory of wireless telegraphy and telephony. What follows is an abstract of the address:—

Of the progress made since the beginning of the war we can find a fairly complete chronicle in the lectures and papers read before this Section. Progress has not been so great with regard to the transmitting plant as with the apparatus for reception, though a paper by Mr. M. Latour gave a glimpse of recent developments regarding some of the alternators being installed in long-range stations. As regards progress in methods and apparatus for reception and in small transmitting sets we obtained a very perfect account from Col. Cusens, who dealt with designs of apparatus evolved for use in the army, and from Major Erskine Murray, who dealt with the designs of apparatus for the Air Force. In addition, Major Prince dealt with wireless telephony on aeroplanes, and Capt. Eckersley with duplex wireless telephony. A complete theoretical and practical account of amplifiers as developed for use in the Navy was given by Prof. Fortescue, and that remarkable instrument the oscillatory valve relay was described by its inventor, Capt. L. B. Turner. All these papers may be regarded as records of finished achievements complete in themselves; certain other papers are in the nature of unfinished symphonies.

On the whole, the outstanding feature of development is the three-electrode thermionic tube sometimes called the pliotron, audion, or three-electrode valve, but which I call a triode. This instrument is in somewhat the same stage of development as the dynamo electric machine was 50 years ago. Now as then, in order that it may be developed to the limit of its possibilities, its characteristics must be studied, endless measurements must be taken, and its theory built up.

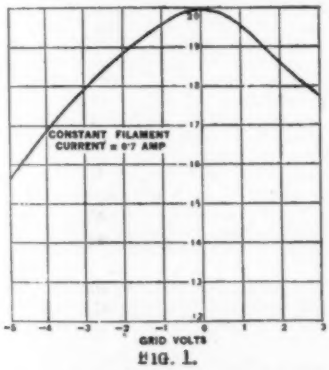


FIG. 1.

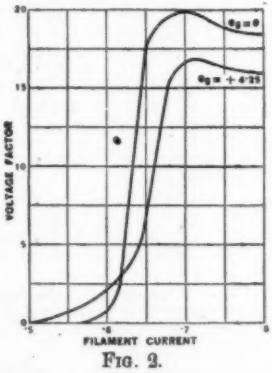


FIG. 2.

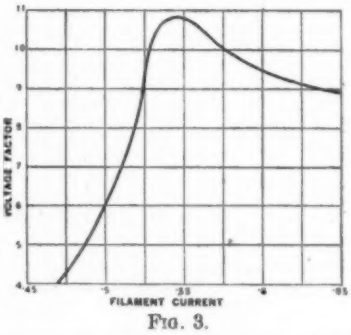


FIG. 3.

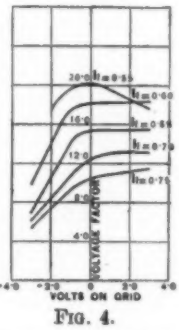


FIG. 4.

As in the case of the dynamo and motor, theory and practice must proceed together, and we may almost say "useless each without the other." The design of these tubes for reception, and many of their properties, were discussed in a paper by Mr. B. S. Gossling, and valuable data concerning the filaments were communicated to the *Journal* of the Institution by Mr. Stead.

Certain results not yet fully discussed arise in the use of these tubes, even in respect of such a fundamental parameter as the voltage factor. The voltage factor is the ratio of the free electromotive force appearing in the anode circuit in response to that which is applied in the grid circuit. In certain modes of using the tube, for instance in the tubes occurring in the later stages of a many-stage amplifier, the value of the voltage factor realised is disappointing with certain adjustments. I have had measurements made on many tubes on which a rather large voltage was applied to the grid, the results are shown in fig. 1, in which the ordinates give the voltage factor, and the abscissæ are the voltage of the battery permanently connected in the grid circuit, the filament current being constant.

Another set of results showing how the voltage factor varies with the filament current is given in fig. 2, and for an entirely different tube in fig. 3. These measurements were made by the following students at the Finsbury Technical College: Messrs. C. W. Cosgrove, C. A. Wilck, J. L. Hewitt, W. Gwynne, R. L. Dawson, and E. M. Walden.

Fig. 4 shows the variation of the voltage factor with the voltage on the grid at various filament currents. Anode current constant at 50 volts; filament current is constant on each curve. These curves were made by Messrs. Everitt and Newman. The voltage factor undergoes great variation when the tubes are used for magnifying rather larger changes of voltage than are applied to them in the bulk of wireless telegraph experiments. The reason for the variation of the voltage factor arises out of the unevenness of the temperature of the filament to some extent, but chiefly out of the drop of voltage along the filament. For instance, if the grid be connected to the negative terminal of the filament the grid is 5 volts below the positive end of the filament in potential. Therefore, when a rather large negative voltage of, say, from two to four volts is applied in making the measurements, or in actual use, this end may be put out of action with consequent lowering of the average voltage factor utilised. Again, if the filament current be increased the difference of potential between the grid and the positive end of the filament also increases, with the result that the average voltage factor may again be lowered. Further, if the filament current be considerably reduced, the ends of the filament may become saturated, and the effective voltage factor again reduced. These matters lead to apparent anomalies in the behaviour of triodes applied to other purposes than the reception of faint wireless signals.

Variation of the average value of the voltage factor as the filament current is altered (figs. 2 and 3) bears a striking likeness to the curves depicting the results of some measurements made by Dr. Vincent in 1918 on the change of the wavelength of the oscillations generated by a triode under certain conditions. Perhaps the changes usually occurring in the wave length generated as the filament battery runs down owe their origin to variations in the average value of the voltage factor. By availing oneself of the flat part of the curves the filament current may be set so that the inevitable slight running down of the filament current will for a long time produce no change in the wave length. This matter of constancy of wave length will become of growing importance as the world becomes crowded with wireless stations, in fact crowding of wave lengths is continually receiving international attention now. Methods of transmitting within very narrow ranges of wave length may have to be devised, and in consequence receiving antennæ and apparatus with sharp tuning may become essential. There are other reasons for this latter tendency, namely, the fact that sharp tuning and low losses go together. Important problems will then arise concerning the increased capital expenditure for building low-resistance antennæ and apparatus, and the interest and depreciation will have to be compared with a possible saving of energy and the value of the other advantages of precise tuning. A paper read before this Section by Prof. Howe on the high-frequency resistance of wires has an important bearing on these problems.

Among other insufficiently investigated properties of the triode are those associated with certain portions of the characteristic surfaces which may be used to represent all the principal properties of the tube. When the filament current and voltage are kept constant there remain four principal variables, namely, the anode current i_a, the grid current i_g, the anode voltage e_a, and the grid voltage e_g. If we represent anode current and grid current separately each of these must be regarded as a function of the two independent variables e_a and e_g. Fig. 6 shows three lines at right angles, the horizontal line marked e_a is the axis of anode voltage, that marked e_g is also horizontal, and is drawn perpendicularly through the page away from the reader to represent grid voltages. The line marked i is vertical, and represents either grid or anode current. Upon these axes we may erect surfaces to represent the current flowing in a triode at any assigned values of the two voltages by measuring off to scale these voltages along the appropriate axes and erecting at the point so determined a vertical line with two ordinates equal in value to the observed currents. When this is done we obtain for the anode current such a surface as is shown in fig. 10. The flat top represents the saturation values, the concave sloping surface at the right-hand side follows in the ideal case the three-halves power law, and normally only a

small part of this area on the extreme ring-hand of the picture is utilised. On the left-hand, where the surface descends in a kind of cliff to the axis of the grid voltage, we have a region little investigated and scarcely utilised as yet. This surface was constructed from curves such as those of fig. 5, which are, in fact, sections of the surface made by vertical planes parallel to the axis of anode voltage, and represent what happens to the anode current, at various constant grid voltages, as the anode voltage is increased. At low anode voltages the anode current rises very rapidly. In fig. 11, which is a photograph of a model of a grid-current surface, at low anode voltages the grid current falls rapidly as the anode voltage is increased from zero. On the left-hand of the sharp ridge are represented values of grid current when the anode voltage is negative, that is to say, when practically no anode current is flowing. The concave sloping part obeys the three-halves power law, and the flat top represents saturation. Fig. 9 shows shapes of the grid characteristics from which such a surface as that of fig. 11 is prepared. All the familiar characteristics noted in books and papers can be obtained from these surfaces by making sections.

The rapid rise of anode current and accompanying fall of grid current in the region of low anode voltages requires

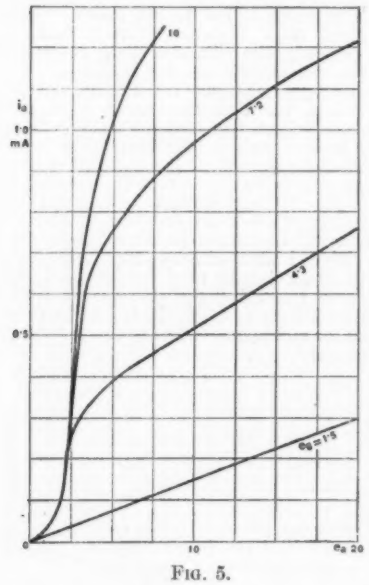


FIG. 5.

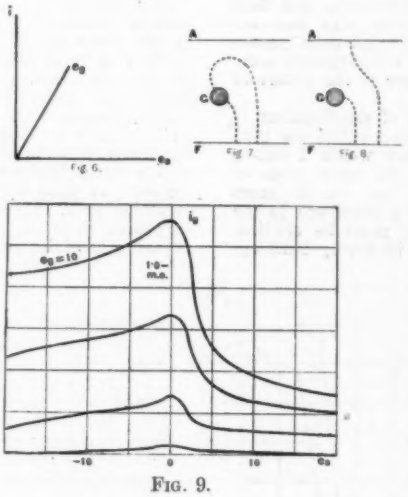


FIG. 9.

explanation. Figs. 7 and 8 indicate possible paths of electrons when the grid is slightly positive and the anode at zero voltage, A being the anode, G a grid wire in section, and F the cathode. Electrons starting from the cathode with considerable normal velocity may perform wide orbits round the grid wire, but are finally drawn into it; but if the anode is slightly positive many of the electrons not passing too near the grid wire end their career on the anode. It may be shown that the grid current has the value:—

$$i_g = A' (e_a + \nu e_g)^{\frac{3}{2}} \exp\left\{-\alpha\sqrt{(e_a/e_g)}\right\},$$

and that the anode current is given by:—

$$\log (1 + i_a/i_g) = \alpha\sqrt{(e_a/e_g)}$$

at low voltages, when ν is the voltage factor and A' and α are constants that are different for each tube; for ordinary reception triodes $\alpha = 1.3$ approximately.

These considerations call attention to a fact that does not appear to have received adequate notice, namely, that the grid in a triode may exert two distinct types of action. The type just described, which is characterised by having the bulk of the grid current contributed by electrons that have suffered great lateral deflections, may be called a snatching action; the other type of action, which is that usually utilised in triodes, is of the nature of an acceleration or deceleration of the motion of the electrons from the cathode to the anode; in brief, one type of action by the grid is mainly lateral attraction of electrons, and the other is mainly a longitudinal effect in the direction of motion. The steep surfaces near the axes of grid voltage in figs. 10 and 11 are due to the snatching action.

In fig. 13 is shown a surface representing by its ordinates both the grid and anode currents of an ordinary form of triode. The snatching action that goes on between the grid and the anode at low anode voltages produces a gully separating the two surfaces. The question immediately arises: What is there beyond the region embraced by this figure? Very little published information is available, but I have had parties of students studying the geography of the gully and the plateau seen in fig. 13; in particular I have to mention the work of Messrs. L. Grinstead and T. W. Price in this connection. As a result I am able to give in fig. 12 a photograph of a surface representing most of the properties of ordinary triodes. The gully noticed in figure 13 is seen to take a sharp turn; on the extreme right of the model a section taken at a fixed and fairly high anode voltage is seen, and this section is, therefore, the characteristic curve of the grid and anode currents as the grid voltage varies. On following the curve of section from front to back the anode current is seen to rise from zero to a maximum as the grid voltage rises to remain nearly constant till the gully is reached and there to descend suddenly; during this descent the grid current rises and becomes greater than the anode current; the plateau beyond the gully belongs to the grid current. This is not strictly what happens in an ordinary reception triode, but certain types of tube gives such a surface with fair exactitude. A form of triode described by Major Erskine-Murray gives a characteristic very like that shown by this section of the model. These models relate to somewhat ideal tubes; in actual tubes, for the reasons already stated, the edges seen on the surfaces are rounded off considerably.

Let us now turn to Capt. H. J. Round's paper on directive telegraphy. It was soon found that false directions were obtained during sunset and sunrise, the errors often ranging over 30 degrees of arc. Throughout the night, too, false directions are given erratically, and, moreover, the sharpness of the minimum is often spoiled. Capt. P. P. Eckersley has suggested that much of the directional error might arise from the rotation of the plane of polarisation of the signal-bearing waves by reflection at non-level portions of the Heaviside layer between the sending and receiving stations. The whole matter provokes inquiry if only because the phenomena affords another mode of gaining knowledge about the upper atmosphere. To show the errors caused by such rotation, however produced, I have here a model of a receiving frame aerial movable about a vertical axis and a ray of electromagnetic radiation incident upon the frame. The ray is represented by a straight rod, and this is fixed at an inclination to the horizontal because it is abundantly proved that rays bending round the globe follow a curved trajectory resembling that of a projectile; for example, Capt. Eckersley has shown that a horizontal loop can receive signals. In the daytime these rays have their magnetic force horizontal. In this model the magnetic force of the wave is represented by a wooden bar fixed perpendicularly to the end of the rod representing the ray; and when the rod is pushed so that its end and the bar touch the frame the latter assumes the position in which an actual frame aerial must be placed to receive no signals, that is, so as to have none of the magnetic force of the waves linking with it. But suppose that at night the plane of polarisation is rotated in any manner; we mimic that by rotating the rod and its perpendicular bar while keeping both in contact with the vertical frame aerial. It is observed that the frame must rotate also, that is to say, the apparent direction of the source of the radiation, namely, the perpendicular to the frame aerial, is erroneous. If γ represents the error, α the inclination of the ray to the horizontal, and β the rotation of the plane of polarisation, then:—

$$\tan \gamma = \sin \alpha \tan \beta.$$

Thus, if it be true that the trajectory of the ray always lies in a vertical plane through both stations, the error in azimuth enables us to compute the angle at which the ray descends to the receiving station.

But there still remains the problem of the cause of the rotation of the plane of polarisation. Those who have thought about the behaviour of an ionised atmosphere towards electric waves passing through it will see at once that the earth's magnetic field will introduce obliquity into the motion of ions propelled by the electric force of the waves. Whether the obliquity so introduced can be of appreciable magnitude is decided by an easy calculation. I have made this calculation on the assumption that the waves traversing the upper ionised atmosphere have an electric field of the order of one volt per kilometre. Waves passing over any particular ion evidently impart to it a to-and-fro motion of the same period as that of the waves, but lagging behind the electric force of the waves by about a quarter period on account of inertia. Now the ion when moving in the earth's magnetic field is deflected by that field, and so acquires an oblique component of velocity. The question is: What magnitude of magnetic field is required to produce an oblique component of velocity of the same order of magnitude as that produced by the electric force of the waves? On taking the case of an oxygen ion I find that a magnetic field of 1,700 c.g.s. units is required; for a hydrogen atom 100 units, for an electron 0.06 unit. Now the earth's magnetic field at the surface has a horizontal component of about 0.18 unit. Therefore, we conclude that a rotation such as is demanded by the observed facts of directive wireless telegraphy could be furnished by

the passage of the waves through a space containing free electrons.

The next step is to see how this motion of the electrons affects reception. In the first place, the setting of the electrons in motion absorbs energy from the waves, and, in fact, may extinguish them, but every vibrating electron is itself a small Hertzian oscillator, and the accumulated effect of the simultaneous oscillation of a whole cloud of electrons may produce an effect at the receiver; the cloud is, in fact, lighted up by the waves, and then the cloud acts as if it were a source. A plane of polarisation of this secondary radiation is the same as that of the motion of the electrons. In these latitudes the vertical electric force of wireless waves will, in conjunction with the earth's magnetic field, cause an electronic vibration in a line descending from the north-east point to the south-west point. Hence the radiation from a cloud of such electrons will arrive at a receiving station due

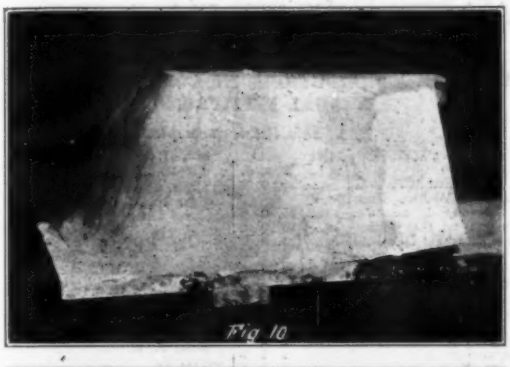


Fig 10.

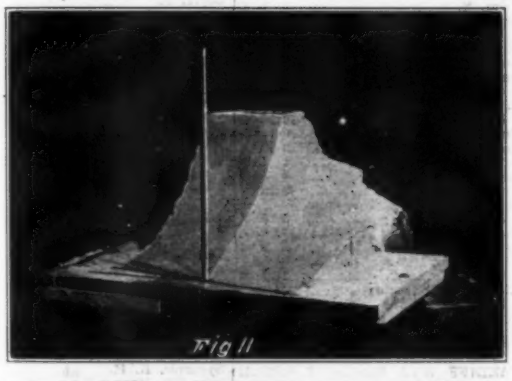


Fig 11

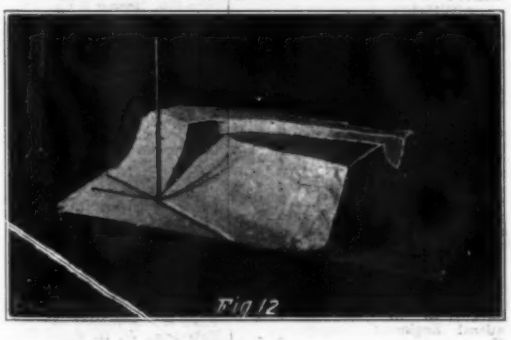


Fig 12

north of the cloud with the magnetic field dipping from west to east, at a station due south with the dip also from west to east, and at stations due east and due west with the dip from south to north. These dipping magnetic fields at the receiving aerial will cause errors of direction as already explained; and if part of the primary waves from the sending station get through as well, the minimum will be ill marked, in fact, the simultaneous reception of the primary waves and the secondary waves in time quadrature will be equivalent to reception of elliptically-polarised waves. Leaving aside the primary wave, which does not necessarily cause any directional error, we see that waves travelling from the south through a high layer of free electrons should give rise to a westerly error if the above conclusions are correct; waves from the north give also a westerly error; waves from the east and from the west give southerly errors. It ought to be possible to test these conclusions by observations.

The information gained from observations made with directive aerials must be combined with the knowledge furnished by the analysis of the records of magnetic variations and magnetic storms. Prof. Chapman read a paper before the Institution setting forth the conclusions he drew from such an analysis. Magnetic storms, he considered, were mainly due to currents in the auroral layers, and the latter never come lower than about 100 kilometres above the earth's surface. Below this is a layer about 50 kilometres thick in which flow the currents causing much of the diurnal variation of the magnetic elements; the conductivity of this layer is produced by the sun's action, but remains throughout the night. Magneticians do not require any other conducting layers in the atmosphere, and this is in sharp contrast with the requirements of the wireless observer; for the enormous difference between day and night signals absolutely demands diurnal ionisation and deionisation of some of the upper layers. Prof. Chapman suggested that the auroral layer was conducting chiefly because of the presence of alpha particles that had come from the sun; I think that wireless investigators would suggest that the layer beneath the auroral layer is occupied by electrons that have come as beta rays from the sun. The atmospheric pressure at above 50 kilometres height is only about a millionth of an atmosphere, the mean free path of the electrons is, therefore, long, and they may possibly remain permanently free in large numbers.

It would seem that the base of this region charged with free electrons must be regarded as the ceiling usually known as the Heaviside layer. And consequently the diurnal variations of the range of wireless signals must be due to the kind of ionisation of gases familiar in laboratory work with X-rays and the gamma rays from radium. In fact, I suggest that this diurnally ionised layer below about 50 kilometres is ionised by the gamma and other ultra-violet rays from the sun, and involves the splitting of electrons from molecules to make positive ions; and at the gas pressures in fairly low levels

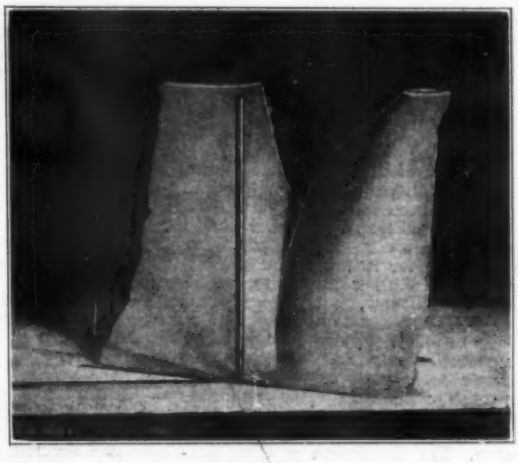


Fig. 13.

many of the electrons will combine with neutral molecules to form negative ions. Both positive and negative ions of molecular size give rise to ionic refraction, and the arched trajectory of the Hertzian rays, and incidentally to absorption also. Prof. Watson's solution of the daylight propagation problem takes account, at least partially, of such a layer of conducting gas, and from his result we may deduce that if the ionisation is effective down to 25 kilometres the conductivity need not be a quarter as great as that of sea-water in order to ensure results such as are summarised in the Austin-Cohen empirical formula.

Dr. A. Graham Bell, whom we are so glad to welcome here to-night, and who has addressed us so invigoratingly, has told us that this Section of the Institution represents to him the advance guard of the British electrical world. Whatever the fascination is due to, it seems to me to be the expression of a true instinct that in our subject we live nearer the growing edge of electrical science than in other branches of engineering; there is infinite scope for knowledge, discovery, invention, and imagination, and I am delighted to know that Dr. Graham Bell is also of that opinion. Along some of the avenues of our particular technology we may catch glimpses of the radiant expanse of the dawning electrical age. The thermionic vacuum tube in itself contains for the engineer of vision some of the most resplendent of these vistas. For from the glowing filament the most subtle and potent of all the gases is evaporated, namely, the gas made up of pure electrons, which must take its turn as a servant of man. And the people of that age will look back and wonder why we in the twilight of the age of steam were so long content to poke slow floods of electricity through the crowded atoms of copper cables.

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION.

Annual Festival.

On Wednesday, last week, the annual festival of the Electrical Trades Benevolent Institution was held at the Connaught Rooms, under the chairmanship of Mr. E. Manville, M.P., who was supported by the vice-presidents Messrs. Ll. B. Atkinson and W. O. Smith and members of the committee. Amongst those present were: Sir James Devonshire, Capt. R. J. Wallis-Jones, Messrs. H. Hirst, W. B. Esson, J. E. Edgecombe, R. W. Hughman, P. Rosling, J. T. Fletcher, J. W. Elliott, L. G. Tate, W. E. Lane, W. R. Rawlings, C. Wilson, H. Bevis, F. C. Raphael, F. H. Nalder, and F. B. O. Hawes (secretary). Letters of regret were received from Sir David Salomons (president), Messrs. G. Sutton, W. Rutherford, Dane Sinclair, E. G. Byng, A. A. Campbell-Swinton, S. Z. de Ferranti, H. W. Clothier, W. L. Madgen, C. H. Wordingham, Capt. H. Riall Sankey, and other well-known supporters of the Institution.

After the loyal toast, Mr. Manville, proposing "Success to the Electrical Trades Benevolent Institution," expressed his appreciation of the honour conferred upon him, one of the oldest members of the industry, but regretted that the fund did not increase as quickly as it should. Its slow progress did not reflect credit on the industry, which in 35 years had become one of the key industries upon which all others depended. Was it right that so little should have been done to provide for the time, which would soon come, when provision would have to be made for those who had failed in the battle of life? It was the duty of the leaders of the industry to see that those who were connected with it should not come to want. Some few firms had made adequate provision for their staffs; those firms also were the first to come forward and subscribe to funds such as this. The smaller concerns could not do much to provide for the future. The staff had at least as strong a claim on the directors as their machinery; the renewal of the latter was provided for—but what about the former? There was an absolute moral obligation on all employers to do what could be done for those who were not able to provide for themselves. There had been few claims on the fund, as the industry had prospered, and many had not reached the age of ceasing work; hence there was a grand opportunity of accumulating funds in readiness for future needs. So far, only £14,780 had been invested. In other industries, of less importance than the electrical industry, better results were shown. The motor industry, quite a young one, in 1914 received £5,500, expended £3,356 in relief, and had a fund of £19,000. In 1919 the figures were respectively £6,426, £5,479, and £36,588, and in the current year the receipts were no less than £17,288, the expenditure £8,000, and the fund £44,600. Further sums had been added, and altogether there was from £80,000 to £85,000 available, putting the comparatively old electrical industry to shame. The Institution of Civil Engineers had accumulated over £100,000.

The local advisory committees were proving very useful in advising on reliefs and as sources of revenue; one was now being formed in Manchester, which would show what Lancashire could do. One of the best ways of raising money was the appointment of collectors; if the heads would take a little more interest in this, much could be done. He would head the subscription list with 100 preference shares in an electrical undertaking which would produce about £6 a year, and he pointed out that those who presented capital benefited the Institution more than if they kept it and presented the interest after deduction of income tax, from which the Institution was exempt.

Mr. Ll. B. Atkinson supported the toast in a humorous speech, in the course of which he discussed the chairman as a "wa(i)ster," and hoped he was not wasting his time by vain appeals. Other allusions were to the sad cases of the contractor who could not get more than £5 a point, resulting in starvation and cannibalism when he had to E.T.U.; of lamp makers attacked by a profiteering committee; turbine builders who fell exhausted into a vacuum, and cable makers whose dielectric losses made them sink into the trenches dug for their own cables. He ended with a serious appeal to the audience on behalf of those who fell by the way.

Mr. W. O. Smith, confessing that he was a hardened sinner who had never subscribed to the fund, declared his conversion, and sought redemption as a Life Governor, expressing the hope that many other hardened sinners would do likewise. The fact that only four applications for relief were received last year he ascribed to the youth of the industry; the pioneers had not had time to grow old, but that time would come. Those who retired before the war on modest savings had to face the enhanced cost of living and must be living on capital; their pensions would die with them, and their dependents would need help. Those who returned from the war with impaired health would age prematurely, and great demands would be made on the funds of the Institution. They should accumulate large sums so that they need turn no one away.

Mr. J. Y. Fletcher, proposing the health of the chairman, said that the Motor Trades' £80,000 was a reproach to the electrical industry. The fund was resting on too few supporters—there must be thousands of men who could contribute to it. He proposed a conference with the secretary of the Motor Trades' fund to get the benefit of his advice. Mr. Manville's name was well known to him as that of one who cared for the needy.

The toast was accorded musical honours, and in his reply Mr. Manville expressed gratification at the result of the festival; beginning with £624, they ended with over £1,031, including an additional subscription from Mr. Hirst of £3 for each year of their personal friendship (£105).

In response to urgent calls for a speech, Mr. Hirst remarked that success in anything depended upon energy in three dimensions—movement, mass, and direction. He commended the fact to their consideration.

During the evening Messrs. Royce and Howell, accompanied by Mr. Bernard Flanders, entertained the company with songs, which were greatly appreciated.

LIST OF CONTRIBUTIONS IN CONNECTION WITH THE ANNUAL FESTIVAL DINNER.

(This list is incomplete.)

CHAIRMAN'S LIST

	£	s.	d.
E. Manville, M.P.	25	0	0
Kincaid, Waller, Manville & Dawson	25	0	0
Devonshire, Sir James	10	0	0
Salomons, Sir David, Bart.	3	3	0
Bishop, O. H.	1	1	0
Wallis, E. C.	10	0	0
Seaman, A. G.	2	2	0
Madgen, W. L.	2	2	0
Peache, J. C.	1	1	0
Paul, R. W.	5	5	0
Ferguson, Pailin, Ltd.	2	2	0
Carmichael, T.	1	1	0
Price, E. L., & Co.	1	1	0
Crapper, Thomas, & Co.	1	1	0
Sinclair, D.	5	5	0
Holmes, F. J.	10	0	0
Butler, H. W.	1	0	0
Electric Construction Co., Ltd.	10	10	0
British Thomson-Houston Co., Ltd.	10	10	0
Babcock & Wilcox, Ltd.	10	10	0
Cash, H. J., & Co., Ltd.	18	10	0
Cash, H. J.	1	1	0
Berkeley, A.	4	4	0
Kemnal, J.	10	10	0
Marconi's Wireless Telegraph Co., Ltd.	5	5	0
Rosling, P.	10	0	0
Esson, W. B.	2	2	0
Wallis-Jones, Capt. R. J., O.B.E.	1	1	0
Electrical Wholesalers' Federation	25	0	0
Sutton, George	10	10	0
Bertram, Thomas	3	3	0
Renfree, T. R.	1	1	0

CARDIFF AND DISTRICT LOCAL ADVISORY COMMITTEE.

Jerrim, F.	0	5	0
Cassels, Dr. T.	0	7	6
Beaver, F.	0	5	0
Chapman, W.	0	5	0
Iles, H.	0	5	0
Denning, W. J.	0	5	0
Lawler, H.	0	5	0
Levy Langfield, G.	0	5	0
Morgan Rees, D.	1	1	0
Wayne Morgan, J.	1	1	0
Morley New, G. G.	0	10	6
James, Jno.	1	1	0
Thomson, G. H.	1	1	0
Bache, Walter J.	0	10	6
Haslam, S. B.	1	1	0
Stretton, T.	1	1	0
General Electric Co., Ltd. (Cardiff)	25	0	0
Bowman, J. M.	1	1	0
Eastwood, J. W.	0	10	6
Lewis, J. E.	1	1	0
National Engineers' Supply Co.	1	1	0
Besley, C. A.	1	1	
Simplex Conduits, Ltd.	3	3	
Smith, A. H.	0	10	6
Cooper, R. G.	1	1	0
Electra Contracting Co.	1	1	0
Santon Engineering Co.	1	1	0
Hill, Sidney	1	1	0
Lake, Fred	1	1	0
Chamen, W. A.	1	1	0
Runnals, H. C.	0	10	0
Miles, F.	0	10	6
Tredegar Associated Collieries Co.	2	2	0
Hobbs, W. E.	1	1	0
Fletcher, R. Howard	2	2	0
Stibbs, F.	0	10	0
Tegetmeier, Norman	0	10	

Mr. H. Bevis's Collection.

Gorton & Halliday	2	2	0
Stott Brothers	10	10	0
Cawson, C., & Co.	2	2	0
Driver & Co.	1	1	0
Hearl, Heaton & Sons, Ltd.	5	5	0
Stern & Knowles	1	1	0

Mr. H. Bevis's Collection—(cont.).

Heilbut, Symons & Co.	10	0	0
Smith, F., & Co.	2	2	0
General Rubber Co., Ltd.	2	2	0

Mr. J. Y. Fletcher's Collection.

Farthing, J. H.	1	1	0
Crawford, F.	1	1	0
Smith, T.	1	0	0
Winder, E. F.	0	10	0
Jepson, A. E.	1	1	0
Boyes, F.	1	1	0
Sims, P. J.	1	1	0
Wink, J.	1	1	0
Steel, E. C.	1	1	0
Richards, W. L.	1	1	0
Cheyne, A. J.	0	10	0
Boyd, W. R. E.	1	1	0
Holt, L. C.	1	1	0
Crush, F.	1	1	0
Wilson, E.	1	1	0
Railing, Dr.	1	1	0
Collection at Works Committee Dinner, Connaught Rooms	8	0	0

Mr. V. F. Holt's Collection.

Farnan, H. F., & Co., Ltd.	2	2	0
Douglas, H. D., & Co.	1	1	0
Anderson & Robertson, Ltd.	5	5	0
Anchor Chemical Co., Ltd.	1	1	0
McConnell & Co., Ltd.	2	2	0
Morris Ashby, Ltd.	1	1	0
British Oil & Turpentine Corporation	3	3	0
Hoare, Marr & Co.	1	1	0
Symonds, R. H.	1	1	0
John Bill, Dresser & Co., Ltd.	1	1	0
Price's Patent Candle Co.	2	2	0
Black, T. F.	1	1	0
Victoria Rubber Co.	5	0	0
Smith, Frederick, & Co., Ltd.	2	2	0
Lindsay & Williams	5	5	0
Stromwall, T.	2	2	0
Rylands Bros., Ltd.	2	2	0
Broomhall, P. B., Ltd.	1	1	0
Johnson, R., & Nephew, Ltd.	1	1	0
Christopherson, Clifford & Co.	3	3	0
Ogden, John, & Co.	1	1	0
Cooper, Dennison & Co., Ltd.	2	2	0
Winter, H. W., & Co.	2	2	0
Lankester & Son, Ltd.	1	1	0
Burgess, Ledward & Co., Ltd.	1	1	0
Solomon, Maurice	3	3	0
Blay, W. F., Ltd.	2	2	0
Taylor Bros. & Co., Ltd.	5	5	0
Typke & King, Ltd.	2	2	0
Langley, Smith & Co.	2	2	0
Helvetia Leather Co., Ltd.	1	1	0
Wool & Fairweather	3	3	0
Robertson, W. H. A., & Co., Ltd.	5	5	0
Watson, R. & W.	5	5	0
Prior, Allen & Co.	5	0	0
East Indies Crude Rubber Co.	1	1	0
Hill, Craven & Hay	1	1	0
Shropshire Iron Co.	2	2	0
Smith, Alfred, Ltd.	5	5	0

Mr. C. E. Hunter's Collection.

Saxonia Electric Wire Co.	1	1	0
Lawton, John, & Sons, Ltd.	1	1	0
Locke, Lancaster, & W. W. & R. Johnson & Sons	2	2	0
Parker, R. H.	2	2	0
Braby, Frederick, & Co., Ltd.	1	1	0
Barwell, C. J.	1	1	0

Mr. W. E. Warrilow's Collection.

Ten Contributions	10	10	0

Mr. L. G. Tate's Collection.

Riggs, W. (Girdlestone & Co.)	5	5	0
Drake & Gorham, Ltd.	3	3	0

(To be continued.)

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Universal Motor.

In *Elektrische Kraftbetriebe und Bahnen* for November 4th and December 4th, an account is given of the manifold applications of a portable electric drill. Apart from the customary uses of the device, special interest attaches to the numerous other processes to which the machine can be adapted; these include sawing, the saw being moved and the work fixed; turning and drilling, the machine being converted into a lathe for either metal or wood turning with the aid of a few simple attachments; grinding and sawing at the bench, &c. In fact, the little machine fulfils the same functions in the workshop as the "Electrical Mary Ann" household motor of Mr. Borlase Matthews was designed to fulfil in the domestic household. Further particulars are to appear in a later instalment of the article. We illustrate herewith (figs. 3-6) some of the applications referred to.

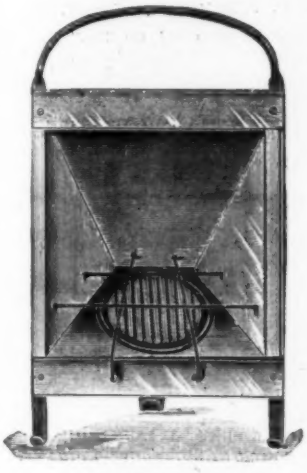
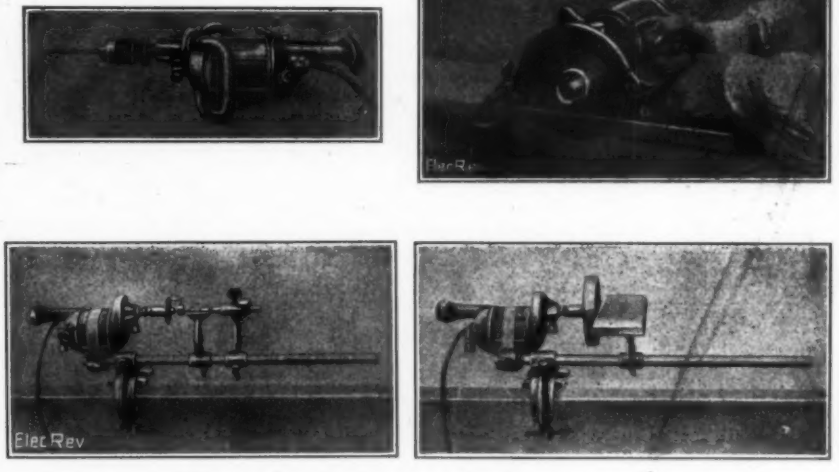


Fig. 1.—A New Electric Fire.



Figs. 3-6.—Small Motor used for Drilling, Sawing, Turning and Grinding.

A New Electric Fire.

A portable electric fire of a somewhat novel type is being placed on the market by Messrs. Baxendale & Co., Ltd., Miller Street, Manchester. The fire has a polished copper reflector and frame, and is fitted with a 750 watt circular element over which a small guard or rail is fitted (fig. 1). The principal feature of the fire is that the back leg is fitted with a spring hinge, and by a slight pressure on the handle the fire sinks back to such a position that the element and the guard for it are both horizontal, and a kettle or pan can then be placed over the element for boiling water or heating milk, &c. (fig. 2). When this operation has been performed, lifting up the fire by means of the handle causes the leg at the back to spring up again, and the fire returns to its original position. It is quite reasonable in price.

Fig. 2.—Fire Adapted for Boiling.

A Turbo-pump Control Switch.

The November issue of *The Mining Electrical Engineer* gives details of an automatic control switch which is claimed by the makers, Messrs. Norrington & Landon, Ltd., to be the only one of its type on the market. This patent oil-break switch combination (fig. 7) has been evolved to meet a special requirement. It is a unit supplied in connection with a mine turbo pump. Colliery engineers have found that these turbo pumps frequently run away from their water, and when they do so, the water in the pump is revolved and churned, air trouble is developed, and usually the bearings seize, causing stoppage and loss of money; not infrequently very expensive rotors are burned out as a result of the seizure.

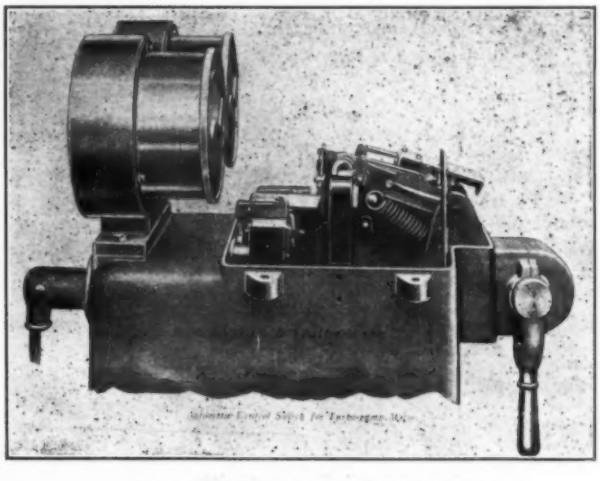


Fig. 7.—A Turbo-pump Control Switch.

The combination switch is a three-in-one, and whilst doing the ordinary duties of a main switch, prevents any such trouble arising; it is, further, able to take care of itself if subjected to improper usage at the hands of rough labour. When the pump loses its water the gear of the switch acts and cuts off the supply, the motor is shut down, and with it the pump. If rough labour sees the pump standing and attempts to switch in (if the pump is still without its water) nothing results. If the pump has got its water, the operation of switching in and starting up can be completed. The switch has, apart from any usual automatic features, an armature which is brought into a given position when putting the switch in. If the water is there and the current valve is right, this armature is drawn up to a magnet pole face and releases a detent, which allows the armature to return should the pump lose its water; otherwise the switch holds in, and the pump runs as long as it has any duty to perform, that is, water to pump. A very clear mechanical indicating device, showing the "on" and "off" position, is provided.

NEW PATENTS APPLIED FOR, 1920.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

34,117. "Electrolytes for electrolytic cells." Metropolitan-Vickers Electrical Co. December 2nd. (United States, December 9th, 1919.)
34,120. "Electric hoists, lifts, inclined railways, &c. Otis Elevator Co. and Waygood-Otis, Ltd. (Otis Elevator Co.). December 2nd.
34,129. "Thermionic valves." F. Reynolds and Silica Syndicate. December 2nd.
34,146. "Electric ignition devices for internal-combustion engines." M. F. Bardeau and Etablissements S.I.C.C.A. December 2nd. (France, January 6th.)
34,157. "Means for locking and unlocking electric switch plugs." J. H. Gath. December 3rd.
34,158. "Electric radiator." A. Worrall. December 3rd.
34,169. "Magneto-electric ignition machines." R. Bosch Akt.-Ges. December 3rd. (Germany, December 3rd, 1919.)
34,179. "Apparatus for timing, recording, and checking telephone calls." J. G. Sutherland and W. C. Sutherland. December 3rd.
34,201. "Induction coil systems." A. C. Gunstone. December 3rd.
34,208. "Electric switches." J. Hall & Co. and G. F. Ostins. December 3rd.
34,218. "Electric switches." British Thomson-Houston Co. (General Electric Co). and General Electric Co. December 3rd.
34,236. "Means for regulating frequency of alternating currents." Soc. Francaise Radio-Electrique. December 3rd. (France, December 6th, 1919.)
34,238. "Electric heating element." Automatic & Electric Furnaces, Ltd. and J. P. Coleman. December 3rd.
34,250. "Rheostats." Wisconsin Electric Co. December 3rd. (United States, October 25th, 1915.)
34,265. "Electrical treatment of ferrous metals during casting." J. H. Wickett. December 3rd.
34,276. "Electric heaters." C. A. Xardell. December 4th. (United States, April 13th.)
34,301. "Electro-magnetically operated time-lag devices." R. Amberton. December 4th.
34,311. "Means for rendering electric light switches, lamp-holders, &c., visible in the dark." W. Emmersen. December 4th
34,315. "Relay devices, &c." J. Scott-Taggart. December 4th.
34,316. "Radio communication signalling systems." J. Scott-Taggart. December 4th.
34,366. "Fuses for electric circuits." J. Adamson and W. de Renzie. December 6th.
34,400. "Electric lamp holder." E. S. Anderson. December 6th.
34,408. "Interrupters for induction coils, &c." H. E. Donnithorne. December 6th.
34,409. "Electric switch." H. E. Donnithorne. December 6th.
34,410. "Stand for examination of materials by X-rays." H. E. Donnithorne. December 6th.
34,411. "Electric heating apparatus." B. K. Hearn. December 6th.
34,423. "Amplifying devices." Siemens & Halske Akt.-Ges. December 6th. (Germany, December 5th, 1919.)
34,447. "Dynamo-electric machinery." H. F. Joel. December 6th.
34,450. "Combined lighting and ignition system for motor cycles." H. Aron. December 6th.
34,469. "Generation of continuous waves for wireless telegraphy and telephony." H. Morris-Airey, C. L. Fortescue, L. G. Preston, and G. Shearing. December 6th.
34,493. "Making and breaking contacts of electric switches." G. Turnock. December 7th.
34,506. "Radio apparatus." L. Cohen and J. O. Mauborgne. December 7th.
34,522. "Electric pocket lamps." O. Hoffmann. December 7th. (Germany, November 4th, 1919.)
34,523. "High and low frequency shunt circuits and arrangements in wireless telegraph receivers." N. P. Hinton. December 7th.
34,536. "Sparking plugs." F. Monin. December 7th. (Belgium, December 8th, 1919.)
34,537. "Electrical apparatus." E. L. W. Byrne. December 7th.
34,543. "Electric light fittings." British Thomson-Houston Co. (General Electric Co.) and General Electric Co. December 7th.
34,554. "Electric heating or resistance elements or units." J. C. C. Macdonough. December 7th.
34,560. "Method of controlling continuous current motors." Oesterreichische Siemens-Schuckertwerke. December 7th. (Austria, January 29th, 1916.)
34,573. "Sound reproducing instruments." W. Glass. December 7th.
34,574. "System of distance control for regulating devices of electric vehicles." Maschinenfabrik Oerlikon. December 7th. (Switzerland, December 30th, 1919.)
34,602. "Dynamos and motors." F. Bryan and G. H. Tatham. December 7th.
34,605. "Limit switch rheostatic brake." A. Davis. December 8th.
34,623. "Sparking plugs." G. H. Barraclough. December 8th.
34,651. "Apparatus for changing velocity ratio and relative direction of rotation of two rotatable parts." Lancashire Dynamo & Motor Co. December 8th.
34,655. "Electric ovens." Electric Heating & Hardware, Ltd., and F. J. Wineberg. December 8th.
34,677. "Electric switches." N. Linslow and A. Reyrolle & Co. December 8th.
34,698. "High-tension ignition for multi-cylinder gas engines." T. Mohn and National Gas Engine Co. December 8th.
34,726. "Regulating systems for electric circuits." British Thomson-Houston Co. (General Electric Co.) and General Electric Co. December 8th.
34,738. "Welding electrodes." A. P. Strohmenger. December 8th.
34,768. "Electric lamp holders, and shade carriers therefor." V. Hope. December 9th.
34,784. "Electrical plug switches, &c." E. Jones. December 9th.
34,787. "Generation of electricity for ships, &c." H. Whiting. December 9th.
34,804. "Electric motor control." British Thomson-Houston Co. (General Electric Co.) and General Electric Co. December 9th.
34,809. "Telephone systems." Automatic Telephone Manufacturing Co. December 9th. (U.S., December 20th, 1919.)
34,816. "Shades or screens for electric and gas lights." G. Youatt. December 9th.
34,829. "Electric horn switches for automobiles." A. H. Richard. December 9th.
34,847. "Fastening device for supporting gas and electrical fitting, pendants, &c." G. H. Tonks. December 10th.
34,868. "Electric cut-outs." R. Baron. December 10th.
34,883. "Mercury electric lamp." J. Barrollier and R. L. M. Belleaud. December 10th. (France, August 14th.)
34,895. "Terminals for high-tension electric cable." A. J. H. Elverson. December 10th.
34,903. "Mercury switches for electrical apparatus." K. Kaisser. December 10th. (Germany, December 15th, 1919.)
34,905. "Magnetos for internal combustion engines." Fabriques des Montres Zenith, successeur de Fabriques des Montres Zenith G. Favre-Jacot et Cie. December 10th. (Switzerland, April 26th.)
34,918. "Electric heating apparatus." C. G. Nobbs. December 10th.
34,953. "Device for fixing ends of strands of electric cables." G. Martinez and Pirelli-General Cable Works. December 11th.
34,967. "Sparking plugs." A. Farrington, G. M. Nicklin, and W. V. Rutter. December 11th.
34,968. "Switches for overhead runways." D. C. Patterson. December 11th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1919.

3,142. "Electrical steering gear." J. Mackintosh and M. Walker. August 6th, 1919. (153,924.)
15,229. "Method of and means for detecting impulses or waves communicated by radiant energy." Comparri Wireless Control Syndicate, and M. Compare. June 17th, 1919. (153,932.)
17,603. "Plates for electric accumulators or secondary batteries." Universal Accumulators, Ltd., and H. de Martis. July 14th, 1919. (153,935.)
17,805. "Circuit arrangements for telephone plants." Relay Automatic Telephone Co. April 2nd, 1919. (141,007.)
17,896. "Electro-magnetic switching apparatus particularly for use in automatic telephone exchanges." Relay Automatic Telephone Co. April 17th, 1919. (141,657.)
20,034. "Electric furnaces." D. F. Campbell. August 14th, 1919. (153,951.)
20,195. "Electro-magnetic switches." British Thomson-Houston Co. (General Electric Co.). August 16th, 1919. (153,963.)
20,325. "Electric switches." A. Pouchain. August 18th, 1919. (Addition to 131,285.) (153,972.)
20,946. "Switch for closing electric circuits only by knowledge of a secret combination of symbols." E. F. W. Leede. August 26th, 1919. (153,980.)
21,634. "Electric telephone and like signalling systems and cables therefor." Western Electric Co. (Western Electric Co.). September 3rd, 1919. (153,995.)
21,992. "Electric fans." P. H. D. Pudumjee. September 6th, 1919. (154,003.)
22,423. "Submarine sound signalling apparatus and the like." T. F. Wall. September 12th, 1919. (Addition to 126,654.) (154,009.)
22,977. "Commutators for dynamo-electric machines." G. A. Juhlin and Metropolitan-Vickers Electrical Co. September 18th, 1919. (154,021.)
23,099. "Electric switches." Crompton & Co. and W. F. Jones. September 19th, 1919. (154,022.)
23,576. "Telephonic and line transmission systems." Western Electric Co. (Western Electric Co.). September 25th, 1919. (154,027.)
23,750. "Bi-polar electrode electrolysers." G. G. Hepburn and Mather and Platt. September 26th, 1919. (154,029.)
27,567. "Electrically-conductive ramp rails." R. Haddan (J. B. Regan). November 7th, 1919. (154,060.)
28,725. "Hollow base electric winches." A. Cunningham. November 19th, 1919. (154,063.)
30,799. "Electric circuit interrupting devices." F. W. Le Tall (Westinghouse Electric & Manufacturing Co.). December 9th, 1919. (154,075.)
31,253. "Storage battery cells." D.P. Battery Co. and J. Waddell. December 13th, 1919. (154,083.)
32,789. "Indicators for electrolytic cells." I. H. Levin. December 31st, 1919. (154,089.)

1920.

1,504. "Magnetos." J. H. Tournayre. February 21st, 1919. (139,155.)
2,781. "Speed control arrangements for dynamo-electric machinery." Siemens-Schuckertwerke. July 3rd, 1917. (138,363.)
4,225. "Electrode holders for use on electric arc welding or cutting." C. B. Waters. February 11th, 1920. (154,104.)
5,549. "Process for the electro-deposition of alloys of copper and zinc." S. O. Cowper-Coles. February 24th, 1920. (154,108.)
9,799. "Spark plugs." A. E. Watts. April 7th, 1920. (154,123.)
11,733. "Toy electric motors." F. Hornby. April 28th, 1920. (154,130.)
15,089. "Mounting and protecting of banks of relays and other apparatus." Western Electric Co. November 24th, 1917. (144,299.)
21,876. "Magneto-electric machines of small size." Philipps Akt.-Ges. July 21st, 1919. (149,346.)

French Railways and Electric Traction.—Down to the present time electric traction on the railways in France has only been introduced in the suburbs of Paris, on mountain railways such as Le Fayet-Chamonix and Valloreine, on the Paris, Lyons & Mediterranean Railway, and the narrow-gauge line from Villefranche to Bourg-Madame on the Midi Railway Co.'s system. The working of normal gauge lines by electricity was about to be realised on the latter company's lines from Lourdes to Montrejeau and the branches leading to the Pyrenean valleys at the end of 1914, but the system was not inaugurated because the Post and Telegraph Administration had not undertaken the necessary measures for the protection of telegraph network from induction, and the company was, therefore, awaiting the permission necessary to start the traffic. As is already well known, the directors of the Paris, Lyons & Mediterranean, the Orleans, and the Midi Railway Companies have decided to convert to electric traction a length of 5,240 miles of railway, commencing with the lines passing at the side of or traversing the mountainous heights from which the rivers spring which are to yield the hydro-electric power to be used in connection with the working of the railways. The Orleans Railway Co. has applied for water power concessions in the valleys of the Dordogne and its tributaries, where about 450,000 H.P. is available, although the power required by the company is estimated at 300,000 H.P. for the working of about 1,860 miles of line. In the case of the Paris, Lyons & Mediterranean Railway Co., the length of railway to be converted is 1,550 miles. The company does not propose itself to establish hydro-electric works in the Alps, but to purchase supplies of power from the existing companies which have submitted for official sanction schemes for very considerably enlarging the productive capacity of their existing works. The engineers of the Midi Co. have for years been investigating the question of electric traction, and would have had 62 miles in operation in 1914 if it had not been for official delay, as previously mentioned. Besides the hydro-electric works established for the working of the Lourdes-Montrejeau line, the company possesses three other works, and has secured control over the principal waterfalls available in the Pyrenees. The total length to be converted is 1,830 miles. It is calculated that the transformation to electric traction of the mileage above mentioned will result in an economy in coal alone amounting to 2,000,000 tons per annum, or 150,000,000 fr., although the programme is expected not to be completed before the lapse of 20 years.